FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 78 Thursday, February 28, 1946 No. 1541

The Importation of Castings

The supply of furniture may be somewhat removed from the furnishing of iron castings, yet both have this in common—they are in very short supply. When any commodity-scarcity becomes chronic, it is usual to seek a remedy by importation. It is just because of this that initially we make reference to furniture, for the employer's federation catering for this industry has, we understand, formed a company to undertake all importation. This appears to us to be sound business for trade in general and well worth as an *emergency* measure. The company which has been formed carries emergency in its title and operates in close association with the appropriate ministry. It is on a similar basis that we advocate that the Council of Ironfoundry Associations form an emergency company to be ready when occasion arises, as arise it will, to handle the import of castings. No better means could be devised for serving industry generally than by the creation of an impartial body which could stategically place such imports. Whilst a few lines of builders' castings were imported before the war, the conditions in those days were quite different. Then no permission to import was necessary, but now it is virtually a matter for a Government department acting in collaboration with the manufacturers, and it seems wise for the makers through their association to act on behalf of their own industry. Only the federation associated with the appropriate industry can know the type or types of castings needed to supplement existing shortages so as to create a balanced supply for the rapid construction of houses. In this connection it is pleasing to report that unforeseen circumstances excepted, there seems but little fear that the foundry industry will not be able to supply all the baths necessary for the building programme without resorting to imports. This statement was made by Mr. W. R. Blair, the chairman of the British Bath Manufacturers' Association, only last week. The occasion was a luncheon held in connection with a visit to the foundry of the British Bath Company at Greenford by Mr. W. Leonard, Parliamentary Secretary to the Ministry of Supply and the Press. This concern is now producing 1,200 baths a week and has at its target 2,000 by midsummer. This will be of the same order as in pre-war days. Other mechanised foundries should shortly be coming into production.

More complicated than light iron castings is the position relative to the supply of engineering components but the same underlying principles of a balanced supply are still paramount. In advocating such a measure, we stress that the whole business must be related to the present emergency, though we do not envisage severe competition in the future, unless it be from oriental sources. We have still much to learn of the industrial progress which has been made in India during the war. We have been told, however, that the military authorities were well satisfied with the quality and quantity of the munitions they received from this source. Certainly, the cost of labour—though more is used for a given production—makes manufacturing for export look attractive at the moment. Fortunately, the more intelligent interest now being taken in the conduct of business by the trades unions will be helpful in aligning international business so that one part of the world should not be unduly benefited by the prevalence of cheap labour to the detriment of other parts.

IRON AND STEEL INSTITUTE

The annual general meeting of the Iron and Steel Institute will be held at 4, Grosvenor Gardens, London, S.W.1, on May 1 and 2. The provisional programme is:—May 1 (morning): Presidential address by Dr. C. H. Desch, F.R.S., followed by discussion on fuel economy in iron and steel works. Afternoon: Continuation of discussion on fuel economy. Discussion on supersonic testing; May 2 (morning): discussion on the overheating of steel. A luncheon will be held at the Connaught Rooms on May 2.

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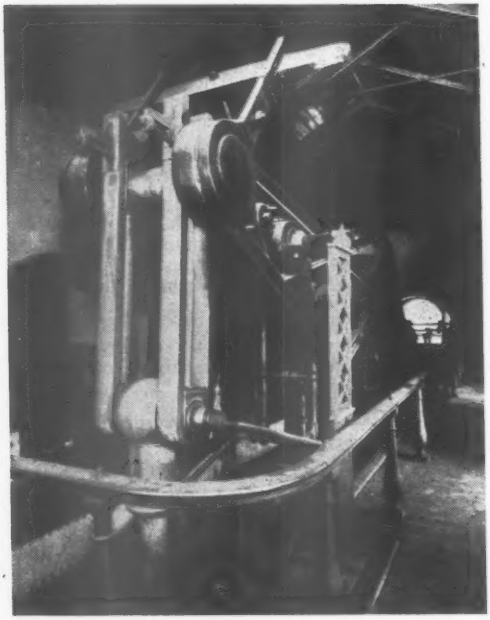
CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

"FOUNDRY WORK IN THE 'SEVENTIES"

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—We were very interested in the article entitled "Foundry Work in the 'Seventies," by T. R. Harris, which appeared in your issue of January 31, 1946, and which referred to a description of the casting foundry of Harvey & Company, of Hayle. This firm was, of course, one of the foremost builders of Cornish beam engines, and over a period of years we have been responsible for the dismantling and demolition of quite a number of their splendid old engines. In 1944 we



LATTICE BEAM OF NO. 4 ENGINE

dismantled two, built by Harvey's, and installed for water-pumping in London in 1853 and 1862, respectively. Brief particulars are as follow:—

No. 4.—Built by Harvey in 1853-54 to pump 4,000,000 galls. per 24 hrs. at 9 strokes per min.; cylinder dia., 72 ins.; pump dia., 22½ ins.; stroke, 118 ins.; head, 195 ft. Parallel motion at each end of the lattice beam is an exact replica of the original Watt motion. The weight is 155 tons.

No. 5.—Built by Harvey in 1862 to pump 5,000,000 galls. per 24 hrs. at 9 strokes per min.; cylinder dia., 80 ins.; pump dia., 24½ ins.; stroke, 120 ins.; head, 195 ft. The construction is similar to that of the No. 4 engine above, but the beam cheeks are solid, reinforced by square section straps of iron drawn up by cotters. The weight is 195 tons.

We told the Newcomen Society about these grand veterans, and the hon. secretary, who is a member of the Cornish Engines Preservation Society, was glad to take the opportunity of inspecting them. No doubt full records and illustrations will in due course be included in the Society's archives.

Enclosed is a photograph of the lattice beam of No. 4 engine—a magnificent example of the ironfounder's art as practised nearly a century ago.

Yours, etc.,
for George Cohen, Sons & Company, Limited,
FELIX L. LEVY,
Director.

Broadway Chambers,
Hammersmith, London, W.6.

TOY DIES

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I understand that one of your subscribers who is a manufacturer of chills for moulding toy aeroplanes, soldiers, etc., and whose works are in either Wakefield or Cleckheaton, has advertised his products in your JOURNAL. I am desirous of contacting this firm, but unfortunately I have been unable to obtain the address. Could you help me in this matter, please?

Yours, etc.,
AMATEUR MOULDER.

[This is typical of several letters we have received, but are unable to trace the source. Can any reader help, please?—EDITOR.]

"MODERN HOMES" EXHIBITION

The "Modern Homes" Exhibition is to be held at Dorland Hall, Regent Street, London, S.W.1, from March 26 to some time in May. Exhibits from the Ministry of Health, Ministry of Supply, the Board of Trade and the London County Council will tell graphically the full story of the planned attack on the housing shortage. The latest advances in kitchens will be among the chief exhibits. Three completely new kitchens will show the latest uses of electricity, gas and solid fuel and the latest ideas to make the work of the housewife easier.

The "House Engine" is an exhibit representing British scientific achievement of far-reaching importance to the living conditions of the people: a new heating unit that can be installed in the space normally occupied by the flue, it combines heat for cooking and warming the whole house and at the same time provides ventilation. New uses for aluminium in the home, including the kitchen utensils and household equipment, will be presented by the Aluminium Development Association. Bedroom furniture will be another aluminium exhibit.

DUPLEX PUMP CASTINGS*

By R. H. BROWN

The methods detailed in this Paper are not always orthodox, unique, or successful, but it should be remembered that the foundry is essentially "jobbing" and may handle during any one week as many as 100 to 150 different patterns. Of the castings produced, varying in weight from an ounce or two to five tons and dimensionally from the size of a penny to 20 ft. long, approximately 85 per cent. are subjected to hydraulic test after machining. These test pressures vary according to the type of service for which the casting is designed, but, generally speaking, are within the range 150 lbs. to 600 lbs. per sq. in. for unalloyed cast iron and 200 lbs. to 4,000 lbs. per sq. in. for bronzes.

Castings are normally produced for absorption by the parent company attached to the foundry and cover a variety of uses, from pumping machinery to mineral water bottling plant. The mineral water section of the factory uses in the main non-ferrous castings and, although these are produced in the foundry, are not unlike the general run of castings made by "odd side" and loose pattern methods. Hence, in this Paper special attention has been paid to the cast-iron field and some typical castings for pump and pumping equipment have been selected for description.

The total output of castings per week is in the order of 25 tons to 30 tons of cast iron and 8 tons to 10 tons gunmetal and bronzes, and is under the supervision of the Author, his assistant, who is responsible for cast iron and gunmetal production generally, and one working chargehand in the non-ferrous foundry.

Layout and Plant

The floor space is divided into two main bays running parallel and producing in the one a variety of dry sand work and in the other green sand work. The coreshop is housed under the same roof, but is literally an offshoot of the dry sand bay. It is served, however, by a 2-ton jib crane that is conveniently placed to both shops in order to facilitate the transport of dried cores direct to the casting ground with the minimum of handling.

The core and mould stoves are of the natural draught accumulator firebrick type, but these have a tendency to cause "hot spots" in the stove and care in loading the drying carriage has to be exercised in order to reduce the possibilities of burned moulds or cores. The core stove is 10 ft. by 15 ft. 6 in. by 8 ft. high and does all the drying required, including the smaller cores. The drying temperature varies slightly due to grade of coke or wind direction, owing to the fact that natural draught is relied upon to maintain heat. A temperature of 200 deg. C. is sought and a temperature recorder is fitted to register dangerous fluctuations. Shelves are fitted round the walls for small cores and the larger cores loaded for drying on a wheeled carriage during the day and dried at night.

The mould stove is very similar to the core stove but larger, the dimensions being 15 ft. 6 in. by 27 ft. by 10 ft. high and, of course, the temperature, again recorded, is higher at about 250 deg. C. The floor of the mould stove is utilised for the drying of core sand, this of necessity being transported in and out by wheelbarrow daily and allowed to cool before being mixed.

Melting Equipment

The melting equipment consists of two 30-in. inside diameter cupolas run usually alternately. With the exception of the linings, the furnaces are essentially as designed by the firm's drawing office and built by the company over 50 years ago. It is surprising that with all the information available at the present day little alteration in design has occurred during this period. The Author excludes, of course, the balanced blast or the pre-heated blast types, but the dimensions shown in Table I will indicate how near to accepted principles are the designs.

TABLE I.—*Cupola Details.*

		Accepted practice.
Internal diameter	30	30
Total tuyere area, sq. in.	98	88-132
No. of tuyeres	4	4 or 8
Height of well, in.	18 in. or 30 cwt. metal	Depends on requirements
Slag hole to tuyeres, in.	12	6-10
Tuyeres to charge door	10 ft. 6 in.	11 ft.-13 ft.
Blast-pressure, in. W.G.	12	8-14
Charges, cwts.	6	7½

The charges weigh 6 cwts. and consist of pig-iron, domestic scrap and returned scrap, the actual percentage varying according to the essential requirements of the casting being made. Generally three different mixtures are run daily, two of these, however, varying in composition only in so far as is required by varying section thickness. The third mixture is used over a wide range of sections and is of the soft high-phosphoric type used only where strength and pressure tightness are not important. Typical mixtures of pig-iron and scrap used with resultant analyses are shown in Table II. Steel mix refined iron No. 7 is used in small quantities, say, 10 per cent. of the charge when required or for special mixes such as the abstract "semi steel" cast iron.

Sand Plant

Both core sand and moulding sand mixers are of the batch type, the former being of the "Rotoil" type of approximately 1 cwt. capacity and the latter

*A Paper read before the British and West of England branch of the Institute of British Foundrymen.

Duplex Pump Castings

an Augusts' Simpson mixer. These two machines give efficient and consistent results with the minimum ot supervision. A typical synthetic core sand mix is given in Table III.

This mix gives sufficient green strength for the cores to be easily handled, being in the order of 2 lbs. per sq. in., with a high dry permeability and average dry strength of the order of 200 lbs. per sq. in. The small percentage of oil added fulfils a twofold purpose, *i.e.*, reduces air drying during storage in hot weather and tends to squeeze out during ramming to produce a harder skin. All ingredients are measured by weight or volume and in the case of the sand a small moulder's bucket is used in preference to the normal 2-gall. size, as this reduces fatigue to a minimum and ensures a full measure each time.

Three normal grades of natural moulding sand are

TABLE II.—*Metal Mixtures Used.*

Grade of iron.	T.C. Per cent.	Si Per cent.	Mn Per cent.	P Per cent.	S Per cent.	Class.
Low-phosphorus foundry	3.2–3.4	2.25–2.5	0.9–1.0	0.3	0.05	1
Low-phosphorus refined	2.8–3.0	3.0–3.25	0.8–0.9	0.18	0.05	2
Low-phosphorus foundry	3.7–3.9	2.5–2.75	0.9–1.0	0.4	0.04	3
Low-phosphorus refined	2.8–3.0	2.5–2.75	1.0–1.1	0.06	0.04	4
Cylinder	3.2–3.4	1.75–2.0	0.7–0.9	0.6	0.04	5
Foundry	3.2–3.4	2.5–2.75	0.8–1.0	1.3	0.025	6
Steel mix refined	2.8–2.9	2.75–3.0	0.8–1.0	0.06	0.04	7

	Mixture A.	Mixture B.	Mixture C.
T.C.	3.1–3.3	3.2–3.4	3.2–3.4
Si	2.0–2.2	1.6–1.8	2.1–2.3
Mn	0.7–0.9	0.7–0.9	0.8–1.0
P	0.2–0.4	0.2–0.4	0.9–1.1
CHARGES :—			
2 cwt. 3	2 cwt. 3	2 cwt. 6	
1 cwt. 1	1 cwt. 4	1 cwt. 3	
1 cwt. 2	1 cwt. 5	2 cwt. returned C scrap	
2 cwt. returned A scrap	2 cwt. returned B scrap	1 cwt. factory or bought scrap	

TABLE III.—*Core Sand Mixture.*

Dry Leighton Buzzard silica sand or Southport sea sand	6 buckets = 96 lbs.
Moist Mansfield red sand	1 bucket = 16 ,,
Semi-solid core compound	4 ,,
Light core oil (linseed)	½ pint.

TABLE IV.—*Moulding Sand Mixtures.*

	Dry sand.	Green sand.	Gunmetal sand.
Mansfield fine red (parts)	8	8	1
Foundry returns ,,	12	12	1
Coal dust ,,		3	
Erith ,,			1
Manure ,,	2		
Synthetic binder (bentonite substitute),,		1	
Green strength, lb. per sq. in.	10	8	7.5
Green permeability, No.	16	18	16
Moisture, per cent.	7	5	6

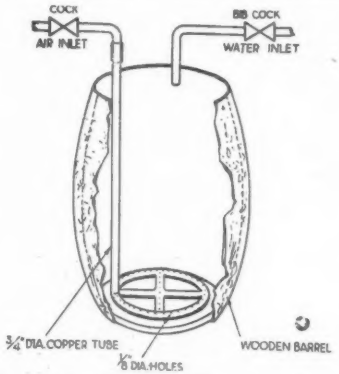


FIG. 1.—APPARATUS FOR PREPARING BLACKING.

used, *i.e.*, dry sand, green sand and gunmetal sand. Mixtures and typical results are tabulated in Table IV.

All natural clay bonded sands are passed over a magnetic pulley for removal of brads, pins and especially pellets, as the Author is convinced that a percentage of reject castings are caused by pellets situated too close to or actually at the mould face.

Mould Washes

Mould and core washes are standardised throughout the foundry. Three methods of mixing can be employed:—(1) By hand, where each moulder mixes to his own requirements and forgets or finds the work too hard to stir each time he uses it; (2) by mechanical means where the blacking solution is mixed in a central plant by means of paddle stirrers or pumps, and (3) by compressed air. The third method is favoured by the Author, as the initial outlay is small, and mechanical wear and tear is negligible. Simplicity should be the keynote of design, as foundry maintenance generally is sadly neglected, and, lastly, efficiency is of a high order, running costs being small.

The plant as suggested by the Author is outlined in Fig. 1 and consists essentially of copper tube suitably bent and brazed with $\frac{1}{8}$ in. dia. holes on the underside. A wooden barrel is used, as this, together with the copper, withstands admirably the erosive and corrosive conditions met with in service. The top connection to the air main is made by a running union to facilitate easy removal and in the Author's foundry the whole apparatus is thoroughly washed out each week, as it is found that starch products used in the proprietary blacking tend to ferment if left stagnant, an unpleasant odour resulting. Moulds and cores are either sprayed or brushed depending on their general shape and accessibility.

FIG. 2.—TYPE I, THE STEAM CYLINDERS, DISTANCE PIECE AND PUMP CAST INTEGRALLY.

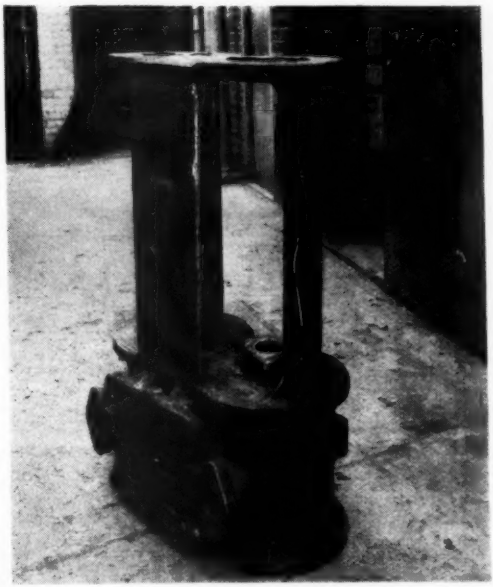


FIG. 3.—TYPE II, THE DISTANCE PIECE CAST INTEGRALLY, BUT THE WATER END SEPARATED.

Air is allowed to bubble slowly through the blacking all day, thus keeping the mixture agitated and allowing well mixed blacking to be available at any time it is required by the moulder.

Laboratory and Shop Tests

Materials and processes where possible, are subjected to laboratory tests and control and include raw material analysis, metal analysis and sand tests. The last are taken twice a day in the morning and after the lunch break, and the results, if varying from standard, are communicated to the shop foreman and the man on the sand plant. A chart is also located in the sand plant for the convenience of the moulders. This indicates the trend of the physical properties of the sand from day to day.

Tensile tests as such are not considered in a sympathetic light by the Author and test-bars are not attached to castings except on the instructions of Government or Lloyd's inspectors. Except for occasional check tests, it is felt that if a good quality

Duplex Pump Castings

iron is maintained the acid test of any casting for the type of work under review is in the final hydraulic test. Shop tests in the form of K bars for porosity and star bars for depth of chill are used as a rough guide to the casting properties of the metal.

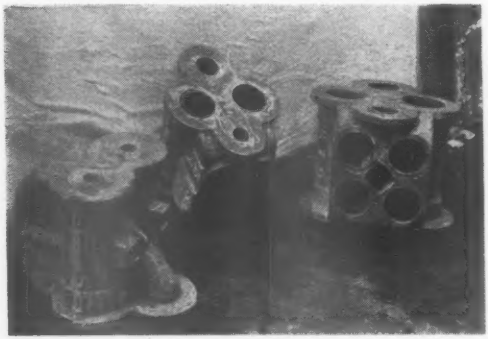


FIG. 4.—CASTINGS FOR TYPE II VARIETY OF PUMPS.

Types of Castings Produced

The illustrations which follow are of a few standard castings being produced regularly. This, however, does not mean that there are large quantities to make, as each pump is tailor-made for the job to be done. Some of the variables which affect the foundry are type of liquid to be pumped requiring an all iron pump or gunmetal lined and fitted; or depth of suction, requiring extra strength in the casting; or type of valve to be used, *i.e.*, disc or ball necessitating modifications to the coreboxes. Generally speaking, however, three main types of duplex pumps are produced: (1) The combined pump where the steam cylinders, distance piece and pump are cast as one unit as in Fig. 2. (2) The separate water end where the cylinder and distance piece are in one unit and the pump cast separately at Figs. 3 and 4, and (3) where all parts of the unit are cast as separate components as in the larger pump (Fig. 5).

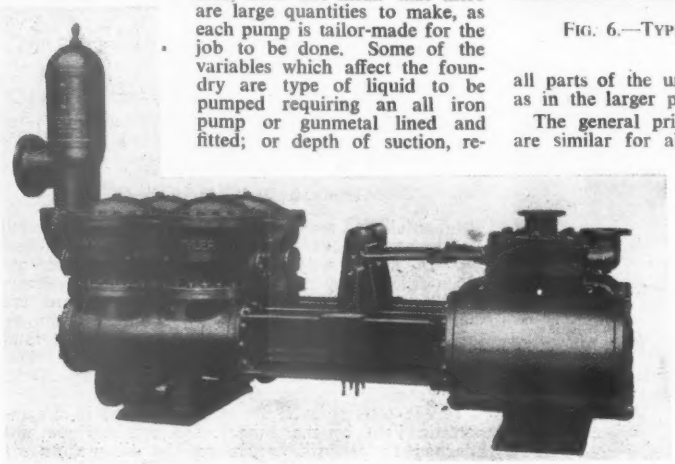


FIG. 5.—WHEREIN ALL THE MAIN PARTS ARE CAST SEPARATELY.

FIG. 6.—TYPICAL STEAM CYLINDER CASTING.

The general principles of moulding and coring up are similar for all types, the main difference being in the size. The following photographs of typical duplex castings will be described with emphasis on special foundry techniques or tackle.

Steam Cylinders

Fig. 6 shows a steam cylinder with internal bore diameter of 18 in. and stroke of 24 in. The casting is machined internally and on the valve face over the ports to take a standard "D" slide valve. Test pressures for these castings vary from 250 lbs. to 300 lbs. per sq. in. and the castings must be free from any signs of internal porosity or defects in the bore. Two

methods of production are available, *i.e.*, vertical or horizontal moulding, but after tests of each method the horizontal has been found to give satisfactory and more economical results.

Fig. 7 shows the general set-up of the dry sand mould and core assembly. A three-part box is used to eliminate the need for coring the exhaust branch and flange. This method of using a loam cake to form the flange may be of interest and the method here described is widely used in the foundry where a joint would normally be used for removal of a loose flange.

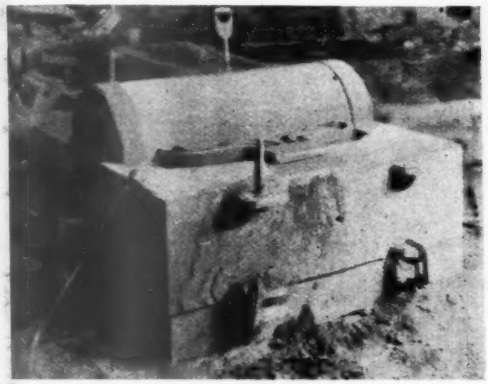


FIG. 7.—TYPICAL MOULD FOR A STEAM CYLINDER.

The bottom half pattern is rammed up in the middle box part up to the top edge of the flange. The flange, being loose, is removed and the mould finished and blacked. A loam cake, larger than the flange, but with a hole the size of the core print is then placed over the finished portion of mould and the drag placed in position, rammed up and clamped. The moulding then proceeds in the normal way. The ad-

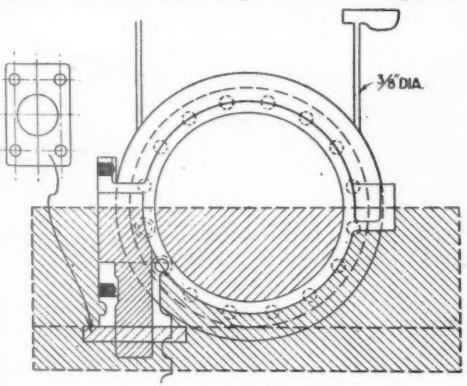


FIG. 8.—METHOD USED FOR MOULDING STEAM CYLINDERS.

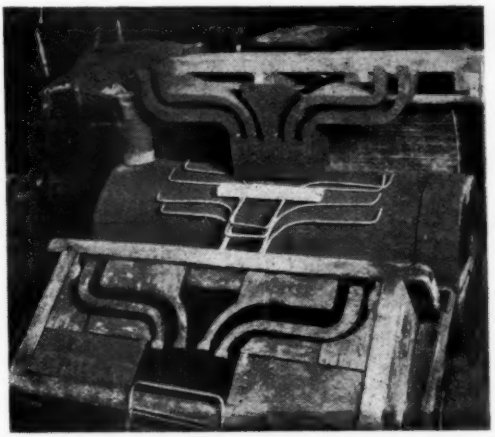


FIG. 9.—CORES FOR STEAM CYLINDER MOULDS.

FIG. 10.—STEAM CYLINDER 16 IN. DIA. AFTER FETTLING.

Duplex Pump Castings

FIG. 11.—SHOWING THE BY-PASS END OF THE CYLINDER.

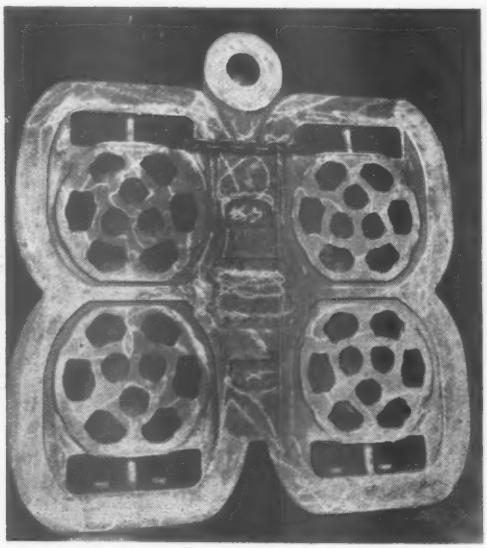


FIG. 12.—THE VALVE PLATE SIDE OF A PUMP.

vantage of this method lies in the reduction of time required to hang the feather edge between the cylinder wall and what would normally be the joint. This is clearly outlined in Fig. 8. Two methods of running have been tried quite successfully and are as follow:—(1) By introducing the metal direct into the flange from above by means of pencil gates ¼ in. dia. and two in number so placed that the metal will miss the central core and fall directly into the flange as shown, or (2) by introducing metal into the end of the flange at an angle of 45 deg. to the core. A riser of rectangular section 2 in. by 1 in. is placed on the top of the flange the opposite end to the runner.

It will be noticed that ample venting through the

FIG. 13.—SHOWS THE CORED-UP MOULD READY FOR CLOSING.

FIG. 14.—VALVE CHAMBER CASTING.

centre of the body core is resorted to and special attention is paid to getting the air away from the box by the hole at each end. A set of cores and the port corebox with a complete set of irons is shown in Fig. 9, and illustrates the necessity of having a core sand with reasonable green strength.

Air Exit Off Ports

The port cores are supported by $\frac{5}{16}$ in. dia. wrought iron bent to shape with insertions of waxed vent to allow easy exit of the air off the ports The air is

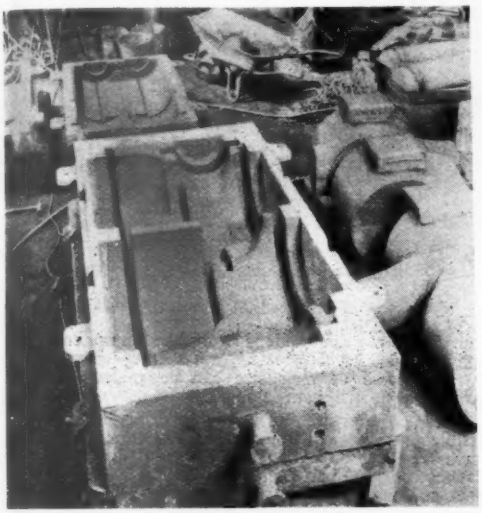


FIG. 15.—MOULD FOR VALVE CHAMBER CASTING.

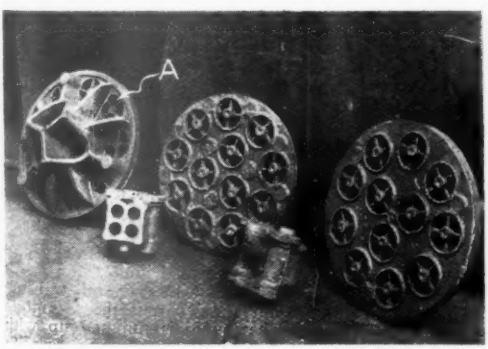


FIG. 16.—CIRCULAR TYPE OF GUNMETAL VALVE PLATE.

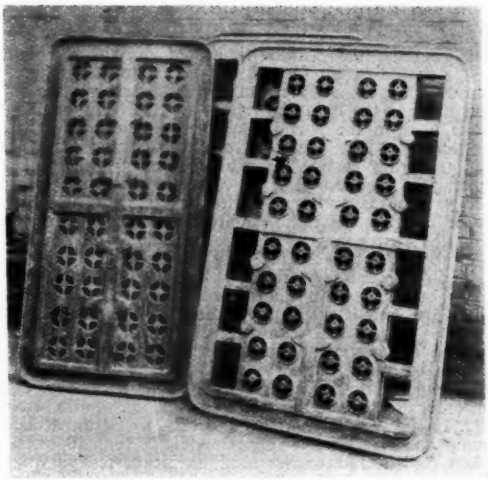


FIG. 17.—RECTANGULAR TYPE OF GUNMETAL VALVE PLATE.

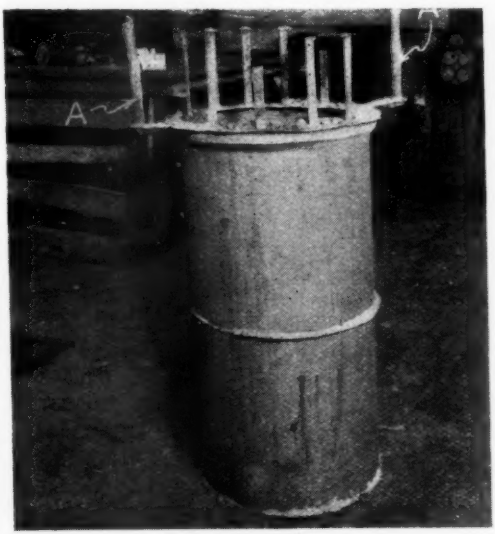


FIG. 18.—BRONZE CYLINDER LINER 34 IN. LONG BY 16 IN. INTERNAL DIAMETER.

Duplex Pump Castings

taken off at the position indicated, provision being made in the mould for the free access to atmosphere. Trouble was experienced on several occasions due to gas holes in the bore and it was eventually found that coke used in the barrel core on quite a number of castings had been the cause due to excessive gas evolution during casting probably caused by the coke finding its way too near the core surface during ramming. Consequently, no ashes or coke are used in cores of this description and care is taken to see that the cast-iron grid used for the support of each half core is not placed too near the face. The general rule in the foundry recently has been to exclude ashes or other fillings altogether and the only time these are used is when the casting is so thin and the core so large that contraction would be impeded causing the casting to crack.

It is essential that these castings be poured hot in the temperature range of, say, 1,300 to 1,350 deg. C. in order to reduce the possibility of blowholes, etc. Fig. 10 shows a view of a 16 in. dia. by 24 in. stroke pump end. It weighs approximately 3 tons 10 cwts. when fettled and carries section thicknesses varying from 1¼ in. to 2½ in. Such castings are subjected to a pressure test of 250 lbs. per sq. in. after machining.

FIG. 19.—SHOWING METHOD OF MOULDING BRONZE CYLINDER LINERS.

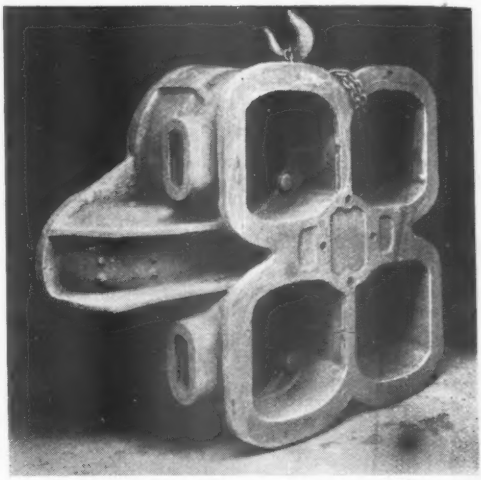


FIG. 20.—VALVE BOX CASTING.

Fig. 10 shows the underside of the pump end, *i.e.*, the foot side when working, but the top side as cast. An indication of their size can be gained by comparison with the man alongside.

These castings are run in the valve plate flange, not visible in this view, but the position where the risers have been cut off can be clearly seen on the suction flange and the barrel flanges. The risers at the neck measure approximately 1½ in. by 2½ in., and as yet no method adopted to supersede rod feeding has proved successful. The main suction core, seen more clearly in a later illustration, together with the by-pass core are held down by chaplets ringed in the photograph.

Provision is made during ramming up of the core for the insertion of a metal plate to take the upward thrust of the core on the tinned iron chaplet. The chaplets used are essentially straight iron rods ⅝ in. dia. with serrated edges for a distance of 2½ in. from the base more like the usual engineering holding-down bolts. It is found that the normal type of plate chaplet cannot be used satisfactorily due to the angle of the core. Stud chaplets are used to hold down the foot cores, which are also fixed into the mould by brads when green.

The next view (Fig. 11) shows the by-pass end and gives a general outline of the mould joints, core joints and stuffing boxes. In this case the method of using a loose flange is again employed, but the technique is slightly different. The mould is rammed up with joints being made at A and B. The mould is then split at A with half patterns left in, the bottom part

FIG. 21.—MOULD FOR VALVE BOX CASTING.

is then split at B, the pattern being supported by means of wood screws placed through an iron bar wedged over the centre of the box, thus leaving the flange which is loose in the bottom part of the box. This is then removed, finished, blacked, and a layer of newspaper placed in the mould. Mould portion B to A is then replaced, clamped into final position, the pattern removed and the mould finished. The newspaper is used to prevent any sand or blacking used in finishing from sticking to the bottom face of the mould. The sand in the middle part is thus supported by bars in the box and also by the bottom portion of the mould, *i.e.*, below joint A. This method reduces the risk of sagging of the middle part of the mould during finishing and drying.

Complicated Core Assembly

The next view (Fig. 12) shows the valve plate side of the pump which is the bottom face as cast and gives a rough idea of the fairly large and complicated core assembly for this type of casting. The oil passage way over the barrels can be clearly seen, these connecting direct to the suction inlet. This view (Fig. 13) of the same job shows the mould and cores assembled ready to receive the top part prior to pouring. The air outlets for the cores can be seen with the gratings at the ends of the box. The space between the core and grating being filled with coke for easy exit of gas and the joint made up with sand. A step gate is used to utilise one pouring basin feeding two 1¼ in. sq. down gates running into two sprays of three ingates each into the bottom flange.

Fig. 14 shows a valve chamber for the pump end previously described. The casting is fairly straightforward as far as moulding and coremaking are concerned and in this instance a fairly even section thickness of 1¼ in. predominates. The hand holes, however, are slightly thicker in comparison with the flanges, but cause no undue trouble providing the metal is to analysis specified. Fig. 15 shows the mould and the cores. Each casting weighs approximately 30 cwt. and is subjected to a 250 lbs. per sq. in. pressure test after machining and before final assembly.

Gunmetal Valve Plates

Figs. 16 and 17 show views of the type of gunmetal valve plates used in these pumps. In the first (Fig. 16) the valve seats are left in the mould by the pattern. This is of metal and is split at A, the moulds being cast with the valve faces downward, hence the top part of the mould has to be freely supported with lifters. The seats must be free from any defect whatever after machining and withstand a pressure test of 250 lbs. per sq. in. In the foreground can be seen two small separate pump ends made in acid-resisting gunmetal for use where corrosive liquor or sea water has to be pumped.

The second (Fig. 17) shows two valve plates, a suction and delivery, measuring approximately 5 ft. 6 in. by 3 ft. and also cast in gunmetal. The special precautions regarding cleanliness of the valve faces must also be observed, as castings are rejected with out question should the seats be slightly defective. Special stress is made of this point, as the effective seating of the disc on the valve seat is essential for pumping efficiency. The patterns are of wood with separate cores for the seats. The risers used, approxi-

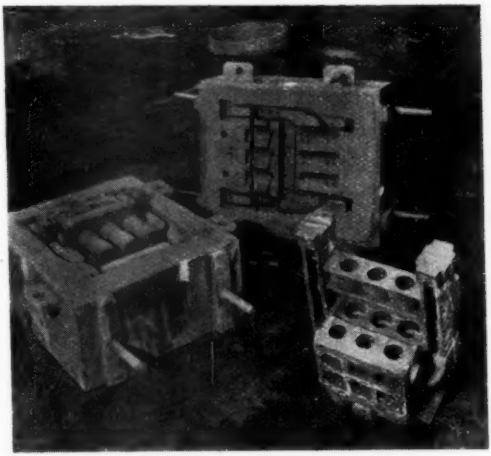


FIG. 22.—CASTING EMBRACING PUMP BODY: VALVE BOX AND SIDE FRAMES.

Duplex Pump Castings

mately 3 in. by 1¼ in. in size, can be seen on the top face of the suction plate. The castings are poured through two down gates running into a spray at either side of the mould and necessitates a double cast. This is essential, as the freezing range of the gunmetal is fairly short and cold shut in the $\frac{5}{16}$ in. wide wings of the seats would result if hot quick pouring was not practised. Drilling recesses in the centre boss of each valve are included in the pattern and can be seen on this view of the casting. The castings are machined all over on both faces.

Bronze Cylinder Castings

Fig. 18 shows a plain cylinder cast in a high tin bronze, but which has caused endless trouble, experiment and patience to be excercised. During the course of evolution of the method of casting the scrap percentage has been reduced from between 60 and 65 per cent. to a present day standard of less than 5 per cent. The casting in this case is 34 in. long, 16 in. internal diameter, and ½ in. wall thickness, finished machined ⅜ in. This is one of many similar castings varying from 10 in. to 14 in. internal diameter and 26 to 34 in. long, that are produced.

The castings are for insertion into the barrels of pump bodies to act as liners and have to withstand exceptionally heavy wear, due to the fact that crude oil or petroleum spirit and sea water may have to be pumped alternately. Consequently, the standard of inspection is of the highest order, *i.e.*, 100 per cent. and no tolerance on the finished machined bore either as regards material or finish. After exhaustive tests and experiment with different moulding methods the general set-up, as indicated in Fig. 19, was adopted, but before passing on, it is as well to notice the method of running which is clearly indicated in Fig. 18. This consists of utilising the well-known pencil gate system comprising in this case eight down gates of ¼ in. by ½ in. section fed from a common runner basin. The side risers are solely for the purpose of allowing the air in the mould cavity to escape in the path of the slowly rising metal hence reducing back pressure to a minimum. The general idea can be gained from the mould assembly.

The pattern, of metal, is shown in the background and is rammed up vertically to leave its own cod. Strengthening iron running the length of the cod and bolted to a bottom face plate are included for stability, the air being taken off at the base. The mould is orthodox, but special attention is paid to venting of the cod, *i.e.*, by needle wiring from the outside to the centre and sleeking over so as to ensure the air strikes back into the cod and not out into the mould. A tapered feeding head is included to allow liquid shrinkage. The runner bush and down gates are shown in this view and also the corebox for the runners. The runner core is made and dried, the runners being drawn from the underside of the corebox. This runner core is placed in position when ramming inside and outside has reached the top of the pattern and the joint made. It is located so that the down gates are central over the pattern. The pouring basin is dried with the mould, the whole being given a wash of plumbago.

FIG. 23.—CASTING FOR A BOILER-FEED PUMP.

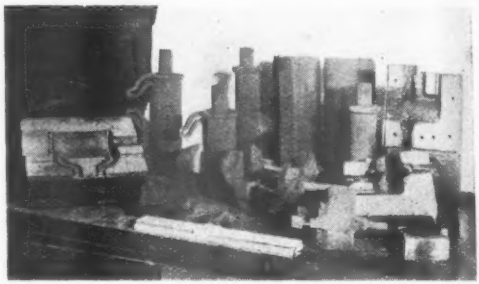


FIG. 24.—CORES AND CORE BOXES FOR BOILER-FEED PUMP CASTINGS.

For a 16 in. diameter liner 700 lbs. of hydraulic gunmetal are required for casting and this takes but seconds to pour. The casting temperature must not fall below 1,250 deg. C. and it is essential when preparing the mould for casting that it stands vertically in order to ensure that the metal will not impinge on the mould walls, but falls directly to the bottom of the mould. It is in order to help to maintain a steady flow of metal that rectangular runners are used. It is generally agreed that round runners give rise to a swirling action of the metal during pouring and at the moment of exit from the down gate tend to spread in much the same way as water does when flowing slowly from a tap. As the mould cavity

is very thin between the walls, tearing of the mould face would inevitably follow if round runners were used although much easier to produce.

Valve Box Castings

The valve box casting shown in Fig. 20 weighs approximately 21 cwts. when fettled and is subjected to test pressures of 250 lbs. per sq. in. and machined on all horizontal faces. The position of the feeding heads can be seen in the illustration and two step gates running to four ingates on the bottom flange

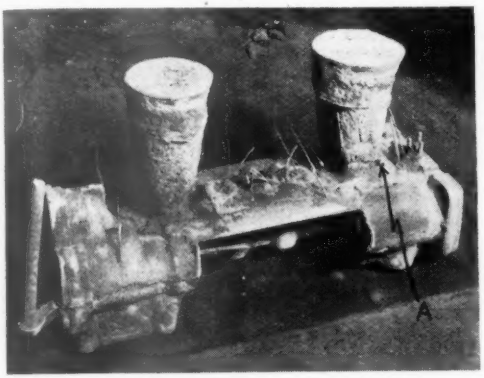


FIG. 25.—CASTING AS STRIPPED FROM THE MOULD.

are used to run the castings. Section thicknesses vary from ¾ in. to 2¼ in. beneath the risers.

The mould, shown in Fig. 21, indicates the coring procedure, the top cores only being visible. Air from all body cores are taken through ample vents to the atmosphere through the cope. Chills at the corners of the centre section are introduced to equalise cooling rate.

Light Pump Castings

The treble barrel pump shown in Fig. 22 consists esentially of the pump body, the valve box and the side frame to receive the crank shaft. A mould assembled ready to receive the cope in the background is shown. These moulds are cast green. The number of cores in the mould total 17, the average thickness being ½ in., but varies from the figure to 3 in. by 2½ in. at the bearing caps. The casting is run through two ½ in. dia. down gates with in gates placed so that hot metal feeds directly into these caps. Test pressures required vary up to 600 lbs. per sq. in. and the casting is machined fairly extensively.

Another fairly intricate casting is the smallest of the type. It is shown in Fig. 23 and is a combined pump and cylinder used for boiler feeding. It has to withstand test pressures of 250 lbs. per sq. in. and over. The castings are jig machined and bored, hence the tolerance on the four barrel cores is very small. Metal pattern equipment is used together with wooden coreboxes with metal inserts to reduce wear to a minimum. The cylinder and pump end are joined by a distance piece which is so designed for rigidity that at the junction special precautions have to be taken to ensure absence of porosity. These take the form of large feeder heads which are topped up with hot metal after casting.

The casting is run in both ends of the pump body in order to reduce burning in of the metal in the thin cored sections. Small blind risers are attached to the flanges at both ends, these being the highest points in the mould, to allow of easier exit of mould gases, at these points. Perforated skimming gates are used on all moulds to reduce the risk of slag entry. A selection of smaller castings is illustrated in Fig. 26 and comprises covers, stools, etc., for various size pumps. The steam chests "A" are made as a complete mould unit from two half cores laid together, bushed, and weighted. A thin wedge runner is formed in the top half core with no risers and it is found that by utilising this method no internal porosity occurs at the stuffing box bosses.

Thirteen small cores comprise a set and the illustration Fig. 24 shows quite clearly the intricacy of the port cores and the exhaust core. In the case of the latter all air from the core has to be taken out of the ⅜ in. dia. neck and through a vent in the mould. After placing in position in the mould, chalk is scraped on the top of the neck to ease location in the cope which is then put on and a vent wire inserted through the cope into the core. Sand is then rammed in to top face and the vent wire withdrawn. This hole is shown in Fig. 25 at A with the wire support protruding. A finer grain core mixture is used for these cores and Southport sea sand has been found to answer admirably.

The Author wishes to express his thanks to the management of Hayward-Tyler & Company, Limited, for permission to publish this Paper, to Mr. H. Dewhurst for the care taken in producing the photographs, and to various members of the firm who have helped in many ways to produce the Paper.

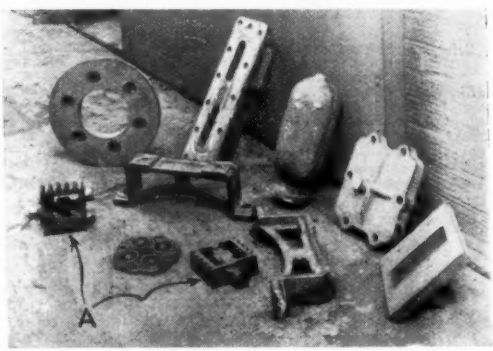


FIG. 26.—TYPE RANGE OF SMALL PUMP CASTINGS.

FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

MARCH 1.

Keighley Association of Engineers :—Members' discussion night. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institute of Welding (South London branch) :—"Welding of Armour," by Major L. F. Denaro. At Borough Polytechnic, Borough Road, London, S.E.1.

MARCH 8.

Manchester Association of Engineers :—"Drop Forgings," by Lt.-Col. J. W. Danielsen. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

MARCH 13.

Institute of Welding (East Counties branch) :—"Steps in Achieving High Quality Welds," by E. Fuchs. At Ipswich.

Institute of Welding (North London branch) :—"Metallurgical Aspects of the Welding of Light Alloys," by Dr. E. G. West. At East Ham Technical College, at 7.30 p.m.

Institute of Welding (West Scotland branch) :—"Welding of Non-ferrous Metals," by H. Martin. At 39, Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.

MARCH 15.

Keighley Association of Engineers :—"Wheels behind the Wheels" (film). At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institute of British Foundrymen

MARCH 1.

Falkirk section :—"Patternmaking," by G. C. Wilson, and annual business meeting. At the Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

MARCH 2.

Lancashire branch :—"Cupola Control," by C. A. Payne. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

MARCH 5.

Burnley section :—Annual general meeting. At the Municipal College, Ormerod Road, Burnley, at 7.30 p.m.

MARCH 9.

Scottish branch :—"The German Non-ferrous Casting Industry," by H. Ellis, and annual business meeting. At the Royal Technical College, George Street, Glasgow, at 2.45 p.m.

West Riding of Yorkshire branch :—Prize winning Paper in the S. W. Wise memorial competition. At the Technical College, Bradford, at 6.30 p.m.

Lincoln section :—"Modern Research on Cast Iron," by H. Morrogh. At the Technical College, Lincoln, at 2.45 p.m.

MARCH 23.

Bristol and West of England branch :—"The Foundry," by W. McCormick. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

Lincoln section :—"A Discussion of Problems in Jobbing Ironfoundries," by A. E. McRae Smith. At the Technical College, Lincoln, at 2.45 p.m.

MARCH 25.

Sheffield branch :—"Precision Casting by the Lost Wax Process," by Adam Dunlop. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

MARCH 27.

Birmingham, Coventry and West Midlands branch :—"A Survey on the Mass Production of Small Steel Castings," by W. H. Bamford. At the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7.30 p.m.

London branch :—"The Education and Recruitment of Foundrymen," by Dr. D. H. Ingall. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

MARCH 30.

East Midlands branch :—Annual meeting and short Paper competition. At the Technical College, Derby, at 6 p.m.

Wales and Monmouth branch :—"Production of Tank Wheels in a Mechanised Blackheart Malleable Foundry," by A. B. Bill and J. Peers. At Newport.

BOOK REVIEW

"Science and Social Order," by C. H. Desch, F.R.S. Published by the Royal Institute of International Affairs, Chatham House, St. Jame's Square, London, S.W.1. Price 1s. net.

All foundrymen regard Dr. Desch as a metallurgist who possesses an almost encyclopædic knowledge of cognate sciences, and because of this achievement he is particularly well armed to write a pamphlet covering this particular field. It is the policy of the publishers to ask authors of their various booklets—this is the sixth—to avoid if possible the use of technical terms and to explain those they are forced to use. Not only has the author kept this well in mind (not very difficult in his case!), but also the implications of the international impacts of science are never lost sight of. Never, to our mind, has the case for the sharing of raw materials by the nations been analysed so carefully, nor more erudite judgment given. A theme, bordering on the speculative, which the Author has discussed in some detail is the possibility of making the "social sciences" really science. He has hopes that solutions may be found. At the moment available knowledge is fragmentary and inco-ordinated, but further work should, if the author is to be believed, supply answers to such questions as to when a revolution will break out in Ruritania, because "certain trends in the life of nations can be detected and expressed in the form of laws of development that prediction within limits is possible." The reviewer was pleased to find confirmation of the view he has held for some time—"That German technology has been so successful, even during the war, is mainly due to the great reserve of scientific and technical skill surviving from the earlier regimes, together with the high importance assigned to the development of inventions of value in war." Thus Nazi education is not well placed fundamentally for the creation of scientists. The book should be read by all foundrymen—they will realise that they are not so backward in their outlook as some of their detractors would imagine—because it will give them the international angle on their work, hopes and accomplishments.

V. C. F.

A NEW FRENCH FOUNDRY MAGAZINE

"Fonderie" is the title of a new French foundry magazine published jointly by the Centre Technique—the research association—and the Association Technique de Fonderie. It replaces "Revue de Fonderie Moderne," which ceased publication during the war. The first issue—January—contains articles on ciment moulding motor-car foundries; control of domestic heating appliances; green-sand moulding of brass taps; air consumption in cupolas; abstracts of foreign articles; and a bibliography. The annual subscription is 650 French francs, but cheaper to members of the A.T.F. It is published from 46, Avenue Victor Hugo, Paris, 16.

SHOT PEENING of aluminium castings is said to enhance corrosion resistance, while obscuring small cracks and surface porosity!

THE GASSING OF BRONZES BY REACTION WITH MOULDING AND CORE SANDS

By W. T. PELL-WALPOLE, B.Sc., Ph.D.

(*Concluded from page* 210.)

Effect of Composition of Bronze on its Sensitivity to Gassing by Reaction with Sand

Tests to determine the effects of the common constituents of commercial bronzes on their sensitivity to the gassing reaction were made with red sand alone, red sand bonded with an oil/cereal product, and in a few cases with sea sand bonded with oil/cereal or with clay. Baking and pouring conditions were standardised as before, *i.e.*, with oil/cereal present sands baked at 200 deg. C., otherwise at 300 deg. C. with free air circulation, pouring temperature 1,250 deg. C., pouring rate the minimum for elimination of shrinkage effects. A blank test (*i.e.*, degassed metal poured through a clean pot) was made with each composition for comparison purposes. Virgin metals and the standard degassing flux were used for all experiments. The ingots were examined as for previous sections, and the results are summarised in Tables XV-XVII.

Effect of Phosphorus Content

The degree of gassing is very sensitive to phosphorus content (Table XVI and Fig. 11). The highest phosphorus content tested (1.5 per cent.) gasses very severely even with sea-sand mixtures which gave very slight gassing in normal 2B8 bronze (0.75 per cent. phosphorus) and it is clear that this alloy is not suitable for casting by any procedure in which the molten metal comes into contact with sand.

Decrease of phosphorus content causes a linear reduction in the extent of gassing by red sand baked at 300 deg. C. Low-phosphorus bronzes (0.075 to 0.25 per cent.) have a gassing index of 1.5 to 2.5, compared with 4 to 5 for 2B8 bronze.

When red sand is bonded with oil/cereal and baked at 200 deg. C., the gassing of 2B8 bronze is greatly reduced, but the low-phosphorus bronzes are gassed more than with red sand alone. Possibly a different mechanism comes into play with oil bonds. Thus a hydrocarbon gas evolved by the oil might protect the metal from being gassed by water vapour, while itself exerting a gassing action independent of the phosphorus content of the bronze. In any case, the results indicate that with low-phosphorus bronze clay-bonded or naturally bonded sands, baked at not less than 300 deg. C. should be used in preference to oil-bonded sands, from the point of view of gas pick-up.

Effect of Tin Content

Variation of tin content from 5 to 10 per cent. with constant phosphorus content causes only a slight increase in sensitivity to gassing, but further increase of tin content to 15 per cent. produces a rapid increase. (See Table XVI, and Fig. 12.)

Effect of Zinc Content

The tin content was not kept constant when investigating the effect of zinc content, as in all commercial gunmetals zinc is used to replace tin rather than as an addition. The gassing of compositions 88/10/2, 88/8/4 and 88/7/5 was investigated (Table XVII). With naturally bonded red sand, 88/10/2 is gassed much less than 2B8, the results being of the same order as for low-phosphorus 12 per cent. tin bronze. Replacement of more tin by zinc causes a slight increase in gassing and since it has been shown that decrease of tin content decreases gassing, it is clear that gassing increases with increase of zinc content up to 5 per cent. With higher zinc contents such

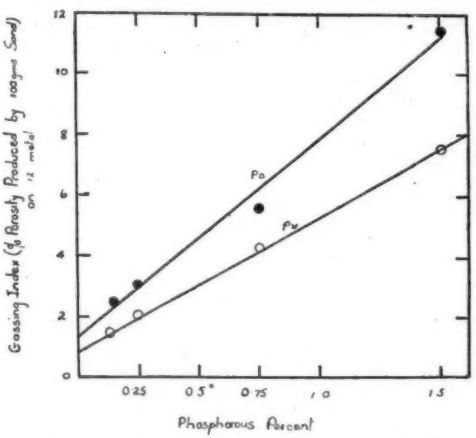


FIG. 11. EFFECT OF PHOSPHORUS CONTENT OF 10 PER CENT. TIN BRONZE ON ITS SUSCEPTIBILITY TO GASSING BY REACTION WITH RED SAND.

as those present in brasses, gas absorption would probably be eliminated due to the high partial pressure of the zinc vapour.

With oil/starch bonded sand baked at 200 deg. C. gassing is very much less in these gunmetals than in the low-phosphorus zinc-free bronzes, again implying that the gassing with oil/starch bond is different from that with the natural or clay bond.

With sea-sand and oil/starch bond no measurable

The Gassing of Bronzes

degree of gassing occurred with 88/10/2 gunmetal, *i.e.*, observed porosity is less than 2 per cent.

Effect of Lead Content

Increase of lead content in straight tin bronzes causes a marked reduction in their sensitivity to gassing, and in the bronze 75Cu; 5Sn; 20Pb, no appreciable porosity was produced either with red sand alone or with the red sand/oil/starch mixture (Table XVII). Similarly the results for the leaded gunmetals 86/7/5/2 and 85/5/5/5, and for leaded phosphor bronze (7 tin, 3 zinc, 3 lead, 0.5 per cent. phosphorus) show that increased lead content decreases gassing.

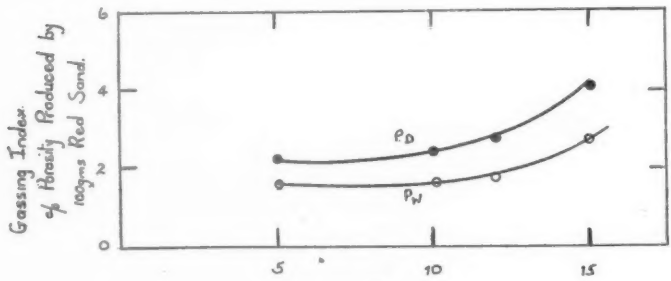


FIG. 12—EFFECT OF TIN CONTENT OF PHOSPHOR BRONZE (0.15 PER CENT. PHOSPHORUS) ON ITS SENSITIVITY TO GASSING.

Effect of Small Additions of Some Elements which may be Present as Impurities in Bronzes

The effects of small additions of antimony, arsenic, aluminium and silicon on the sensitivity to gassing of a 10 per cent. tin bronze are summarised in Table XVIII. The effects of these additions on the bronze in the absence of gas absorption, are shown in Table XIX. It should be noted that in the absence of gas, contamination by small amounts of aluminium or silicon seriously reduces the tensile properties and lowers the soundness. In both cases these effects are due to entrapped oxide skins. Antimony and arsenic in amounts up to 0.5 per cent. have little effect on the properties of gas-free 2B8 bronze.

When melts with corresponding additions of these elements are poured through the Salamander pot lined with a known weight of red sand, it is seen that the presence of aluminium or silicon inhibit gassing, while antimony and arsenic tend to increase slightly the sensitivity to gas absorption. The action of silicon in this respect confirms Baker's observations.

General Discussion of Effects of Constituents

The variation in the extent of gassing with change in composition suggests that the sensitivity to the gassing reaction depends on (*a*) the heat of formation of the oxide of the element concerned, and (*b*) the tendency for the formation of a tenacious oxide skin

TABLE XV.—*Properties of Gas-free Ingots of Bronzes and Gunmetals for Comparison with Ingots from Gassing Tests*

Analyses.				Pouring Rate. Lb./min	Pouring Temp. Deg. C.	Density.			Tensile Properties.				Ingot Ref. No.
									Upper T.P.		Lower T.P.		
Sn Per cent.	P Per cent.	Zn Per cent.	Pb Per cent.			Bulk.	Upper T.P.	Lower T.P.	U.T.S.	El. Per cent.	U.T.S.	El. Per cent.	
10.0	1.49	—	—	8	1,250	8.67	8.65	8.65	29.6	30	27.0	16	562
10.1	0.75	—	—	8	1,250	8.77	8.78	8.76	27.5	31	26.6	22	563
10.0	0.50	—	—	8	1,250	8.85	8.85	8.80	26.8	36	25.0	21	564
9.8	0.25	—	—	10	1,250	8.86	8.88	8.86	25 4	54	22 1	17	565
9.7	0.15	—	—	10	1,250	8.87	8 85	8.83	23.6	42	—	—	566
9.9	0.08	—	—	12	1,250	8.87	8.86	8.81	22.9	24	17.1	8	567
5	0.15	—	—	10	1,250	8.86	8.85	8.85	20.3	57	20.4	49	568
9.7	0.15	—	—	10	1,250	8.87	8.85	8.83	23.6	42	—	—	569
12.7	0.20	—	—	8	1,250	8.86	8.82	8.82	22.8	5	22.7	5	570
15	0.15	—	—	8	1,250	8.86	8.84	8.84	23.8	3	19.0	1	571
10.0	0.10	1.5	0	12	1,225	8.81	8.82	8.80	19.9	14	18.8	11	572
8.6	0.08	4.0	0	12	1,225	8.81	8.84	8.76	22.0	18	20.9	16	573
7	0.08	5	0	12	1,225	8.79	8.77	8.77	19.7	20	15.5	10	574
7.0	0.10	4.7	1.9	12	1,225	8.81	8.81	8.78	18.8	19	20.3	23	575
4.6	0.01	4.5	5.6	12	1,250	8.82	8.83	8.81	18.4	28	15.7	8	576
7.8	0.42	1.3	3.4	8	1,250	8.84	8.85	8.84	25.3	28	23.9	16	577
9.7	0.05	—	8.7	8	1,250	8.96	8.97	8.94	19.4	16	18.4	13	578
4.9	0.06	0	19.5	12	1,250	9.10	9.09	9.07	15.8	22	15.2	19	579

which isolates the metal from the sand. Thus, phosphorus, zinc, tin, affect gassing to a decreasing extent in that order and the heat of formation of their oxides decreases in the same order, but aluminium and silicon inhibit gassing due to the formation of a tough continuous oxide skin, although the heats of formation of their oxides are greater than any of the foregoing elements.

The action of lead in restraining gassing is only partially explained by these considerations, but it

TABLE XVI.—*Effect of Tin and Phosphorus Contents on the Gassing of Phosphor Bronzes. Poured at* 1,250 *deg. C.*

Ingot Ref. No.	Composition.		Pouring Rate.	Sand.*			Density.			Tensile Properties.				Gassing Index.	
										Upper T.P.		Lower T.P.			
	Sn Per cent.	P Per cent.		No.*	Wet Wt.	Dry Wt.	Bulk.	Upper T.P.	Lower T.P.	U.T.S.	El. Per cent.	U.T.S.	El. Per cent.	P_W.	P_D.
580	10	1·5	6	1	87	58	8.23	—	8.16	—	—	15.7	4	7.6	11.5
581	10	1.5	6	2	80	53	8.28	8.24	8.21	19.6	5	18.4	6	6.0	9.0
582	10	1.5	6	3	81	52	8.38	8.28	8.40	19.6	6	18.3	12	4.5	7.0
583	10	1.5	6	4	85	63	8.30	8.07	8.40	12.5	6	24.3	17	5.4	7.3
584	10	1.5	6	5	93	67	8.18	8.08	8.15	16.4	3	16.0	3	6.5	9.0
351	10	0.75	8	1	83	62	8.51	8.51	8.61	23.8	12	24.2	14	4.2	5.6
585	10	0.75	8	2	86	50	8.59	8.51	8.64	24.0	15	23.8	15	3.0	5.2
414	10	0.75	8	3	82	55	8.69	8.71	8.70	27.4	27	25.5	20	1.8	2.7
397	10	0.75	8	4	80	59	8.58	8.57	8.58	24.9	10	22.4	9	3.4	4.6
587	10	0.5	8	1	84	56	8.59	8.55	8.60	17.4	7	23.4	19	3.7	5.5
588	10	0.5	8	2	85	50	8.67	8.67	8.70	24.9	26	23.4	23	2.6	4.4
589	10	0.25	10	1	80	53	8.78	8.79	8.77	25.0	38	17.6	9	2.0	3.0
590	10	0.25	10	2	85	50	8.62	8.59	8.62	19.6	14	17.6	9	3.9	6.6
591	10	0.25	10	2	89	52	8.68	8.69	8.75	22.8	20	22.7	24	3.1	5.3
592	10	0.15	10	1	89	60	8.81	8.84	8.81	23.5	29	18.7	12	1.6	2.4
593	10	0.15	10	2	85	50	8.64	8.66	8.64	20.6	16	17.2	9	3.9	6.6
594	10	0.15	10	2	96	56	8.66	8.65	8.54	24.0	12	17.9	6	3.3	5.6
595	10	0.075	12	1	83	55	8.79	8.81	8.78	21.4	21	16.7	9	2.1	3.2
596	5	0.15	10	1	99	66	8.81	8.78	8.78	19.9	49	15.9	22	1·5	2.2
597	12	0.15	8	1	77	48	8.82	8.82	8.79	25.5	21	18.8	6	1.7	2.7
598	12	0.15	8	1	85	57	8.80	8.79	8.79	22.8	7	21.6	7	1.8	2.7
600	12	0.15	8	2	80	47	8.71	8.64	8.75	20.9	14	19.2	3	3.2	5.5
601	12	0.15	8	2	76	44	8.77	8.76	8.73	24.1	10	21.4	6	2.5	4.4
602	15	0.15	8	1	87	58	8.73	8.68	8.50	18.8	2	16.7	2	2 7	4.1

* *Sands*: No. 1. Red sand alone baked ½ hr. 300 deg. C.
2. ,, ,, plus 5 per cent. oil/starch. Baked ½ hr. 200 deg. C.
3. Sea ,, ,, ,, ,, ,,
4. ,, ,, ,, 20 per cent. aluminous cement. Baked ½ hr. 300 deg. C.
5. ,, ,, ,, 5 per cent. water-glass. ,, ,,

TABLE XVII.—*Effect of Zinc and Lead Contents on the Gassing of Gunmetals and Leaded Bronzes. Ingots Poured at* 1,250 *degl C.*

Ingot Ref. No.	Pouring Rate. Lb./ min.	Composition.*				Sand.			Density.			Tensile Test				Gassing Index.	
												Upper T.P.		Lower T.P.			
		Sn Per cent.	Zn Per cent.	Pb Per cent.	P Per cent.	No.*	Wt. Wet.	Wt. Dry.	Bulk.	Upper T.P.	Lower T.P.	U.T.S.	El. Per cent.	U.T.S.	El. Per cent.	P_W.	P_D.
605	12	10	2	—	0 05	1	91	61	8.73	8.72	8.68	14 0	4	16.1	5	2.7	4.1
606	12	10	2	—	0 05	2	86	51	8.78	8.73	8.75	15 2	5	14.2	7	2.2	3.7
607	12	10	2	—	0.05	2	88	52	8.80	8.80	8.77	19.6	18	18.0	9	1.9	3.2
608	12	10	2	—	0.05	3	83	56	8.80	8.78	8.78	18.4	9	15.5	3	2.0	3.0
609	12	8	4	—	0.05	1	90	60	8.64	8.63	8.68	15.2	7	14.4	6	3.5	5.3
610	12	8	4	—	0.05	2	90	53	8.75	8.72	8.72	18.0	12	16.3	10	2.1	3.6
611	12	7	5	—	0.05	1	86	47	8.67	8.65	8.68	17.0	15	15.2	10	2.9	5.3
612	12	7	5	2	0.05	1	88	59	8.70	8.68	8.72	17.1	16	19.2	19	2.7	4.0
613	12	7	5	2	0.05	2	80	48	8.77	8.75	8.70	18.5	17	15.8	14	2.0	4.1
614	12	5	5	5	0.05	1	92	61	8.70	8.65	8.75	14.4	16	15.6	19	3.0	4.5
615	12	5	5	5	0.05	2	81	48	8.77	8.78	8.78	17.9	27	15.5	19	2.5	4.2
616	12	5	5	5	0.05	3	78	46	8.81	8.81	8.81	17.2	24	14.4	18	2.0	3.4
617	8	7	2	3	0.5	1	87	58	8.75	8.78	8.72	23.3	20	19.4	14	2.6	3.9
618	8	7	2	3	0.5	2	86	51	8.68	8.70	8.64	22.8	23	19.3	13	3.5	5.9
619	8	10	—	10	0.05	1	76	51	8.87	8.94	8.85	17.8	6	15.6	4	1.9	3.1
620	8	10	—	10	0.05	2	89	53	8.85	8.81	8.83	16.6	4	15.6	5	1.9	3.1
621	12	5	—	20	0.10	1	83	56	9.08	9.07	9.08	14.4	11	15.2	12	1.6	2.4
622	12	5	—	20	0.10	2	83	50	9.15	9.10	9.13	14.0	12	13.8	13	0.7	1.1

* *Sands*: No. 1. Red sand alone, baked 300 deg. C.
2. ,, plus oil/starch (5 per cent.), baked 200 deg. C.
3. Sea ,, ,, 5 per cent. oil/starch ,, ,, ,,

The Gassing of Bronzes

appears to give rise to some definite protective action against the steam reaction.

General Conclusions

(1) Severe porosity and low mechanical properties can be caused in bronzes by reaction between the molten metal and naturally or synthetically bonded sands, *e.g.*, in sand moulds, cores, sand-coated chill cores, moulded sand pouring funnels, runner bushes, etc.

(2) The extent of gassing is determined by the following factors:—(*a*) The quantity of sand with which the metal comes into contact; (*b*) The nature and concentration of the bonding agent. Oil bonds gas least, cereal bonds next and clay bonds worst; (*c*) The mechanical grade of the sand. The finer the grade the more the gassing due to increased clay content and decreased permeability; (*d*) The water content of the sand, determined by baking conditions. Maximum air circulation is required with baking temperature $\lessdot$ 200 deg. C. for organic or $\lessdot$ 300 deg. C. (preferably 600 deg. C.) for clay-type bonds; (*e*) The temperature reached at the reacting surface, determined chiefly by the pouring temperature. The higher the temperature the greater is the gassing; (*f*) The composition of the bronze. Gassing is most severe in high phosphorus bronzes such as 2B8, but decreases considerably when phosphorus content is reduced to 0.25 per cent. or less. Gunmetals are much less susceptible to gassing than are the phosphorus bronzes, but their sensitivity increases with zinc content (up to 5 per cent.). Gassing also increases slightly with tin content, but increase of lead content in phosphor-bronze or gunmetals definitely reduces gassing and the leaded bronze 75 Cu, 20 Pb, 5 Sn appears to be immune.

(3) The presence of gas in the metal before pouring increases the total porosity of the bronze which picks up additional gas by the sand reaction.

(4) Pouring rate has no effect on the porosity of gassy metal, hence a higher pouring rate can be used than those recommended for pouring gas-free metal in cast-iron moulds, thus permitting a lower pouring temperature which decreases the extent of gassing.

Recommendations

(1) In all processes in which molten bronze comes into contact with naturally or artificially bonded

(*Continued on page* 240.)

TABLE XVIII.—*Effect of Impurities on the Sensitivity to Gassing of* 2B8 *Bronze. Poured at* 1,250 *deg. C. through Pot Lined with Unsieved Red Sand baked* 300 *deg. C.*

Addition.	Wt. of Sand.	Pouring Rate. Lb./min.	Density.			Tensile Test.				P_W.	P_D.
						Upper T.P.		Lower T.P.			
			1¼-in. Bar.	Upper T.P.	Lower T.P.	U.T.S.	El. Per cent.	U.T.S.	El. Per cent.		
—	85	8	8.55	8.59	8.52	20.8	9	17.1	2	—	—
0.05 per cent. Al ..	83	10*	8.78	8.78	8.80	17.7	3	25.0	10	†	†
0.1 per cent. Al ..	97	10*	8.69	8.72	8.66	10.2	1	19.2	4	†	†
0·5 per cent. Al ..	101	10*	8.66	8.71	8.63	23.0	7	21.2	6	1.8	2.5
0.1 per cent. Si ..	81	10*	8.76	8.75	8.78	23.6	13	21.5	8	†	†
0.5 per cent. Si ..	85	10*	8.71	8.70	—	21.8	5	—	—	†	†
0.1 per cent. Sb ..	87	8	8.33	—	8.31	—	—	* 16.6	2	0.2	—
0·5 per cent. Sb ..	81	8	8.49	8.35	8.57	9.2	1	20.9	6	4.8	—
0·1 per cent. As ..	96	8	8.56	8.39	8.59	12.1	1	21.1	1	3.1	—
0.5 per cent. As ..	95	8	8.42	8.16	8.75	11.7	3	19.7	8	4.7	—

* Higher rate required by sluggish melt due to oxide skins.
† Porosity values are equivalent to those for ungassed metal, hence P_D and P_W are negligible.

TABLE XIX.—*Effect of Impurities on Properties of Gas-free Chill-Cast Ingots of* 2B8 *Bronze Ingots,* 14 *in by* 1 *in.*

Addition. Per cent.	Pouring Rate. Lb./min.	Densities.			Tensile Strength.			
					Upper T.P.		Lower T.P.	
		Bulk.	Upper T.P.	Lower T.P.	U.T.S.	El. Per cent.	U.T.S.	El. Per cent.
0.02 Al ..	6	8.82	8.84	8.79	26.0	15	23.2	10
0.50 ,, ..	8	8.60	8.75	8.69	26.0	9	22.0	6
0.50 ,, ..	8	8.61	8.72	8.70	25.0	10	19.7	5
0.10 Si ..	8	8.74	8.82	8.78	25.9	10	23.5	7
0.10 ,, ..	8	8.72	8.78	8.78	25.1	8	22.5	6
0.50 ,, ..	8	8.70	8.76	8.72	25.6	9	22.4	6
0.50 ,, ..	8	8.70	8.75	8.71	25.2	8	23.5	5
0.50 As ..	6	8.75	8.74	8.72	30.2	15	29.0	14
0.50 ,, ..	6	8.80	8.79	8.78	24.9	8	26.0	9
0.50 Sb ..	6	8.74	8.80	8.69	26.3	10	24.9	10
0.50 ,, ..	6	8.75	8.80	8.74	25.7	8	25.4	9

REDUCED SCOPE OF ESSENTIAL WORK ORDERS

The Ministry of Labour and National Service have informed bodies representing the employers and workers concerned that one hundred industries or parts of industries will be withdrawn at the end of three months from the scope of the Essential Work Orders. The industries and parts of industries in question are shown in the Appendix. Apart from a few cases in which notices of de-scheduling have already been issued, notices will be issued not later than April 15, 1946, to all the individual undertakings which are to be de-scheduled giving them at least a month's notice of de-scheduling.

As already announced, notice of de-scheduling will be given not later than April 4, 1946, to a number of scheduled undertakings in the engineering industry and to a number of motor vehicle repair shops and garages. By the time the additional de-scheduling referred to in this announcement is completed some five million workers will have been removed from the scope of the Essential Work Orders. It is proposed to withdraw further industries from the scope of the Orders as opportunity offers.

Until individual de-scheduling takes effect, the provisions of the Essential Work Orders remain in force for all employers and workers in scheduled undertakings.

The Minister of Labour and National Service pointed out in the statement which he made in the House of Commons on December 13, 1945, that certain features of the Essential Work Orders may have proved themselves to be of mutual advantage to employers and workers and may also have affected the industrial agreements of the industries which were brought within the scope of the Orders. The object of the three months' notice of withdrawal is to give the two sides of the industries concerned an opportunity of considering jointly any readjustments in their industrial agreements which may be needed to meet the changed circumstances when the Orders are withdrawn.

Amongst the industries to be withdrawn at the end of three months from February 15, 1946, are:—Abrasives; aluminium (basic secondary and alloy smelting); constructional engineering; iron and steel production (except ironfounding, iron and steel tubes, pipes and fittings, and manufacture of steel sheets and tinplate); light alloys (wrought and foundry); and non-ferrous metals (brass, copper, bronze wrought work).

A NEW FACTORY which will give employment to 400 workers is being set up by the Glacier Metal Company, Limited, at Kilmarnock.

FARM MACHINERY PRODUCTION in the United States during 1945 totalled $663,484,196, the Civilian Production Administration has announced. This was an increase of approximately $20,000,000 over 1944 output. Export shipments of farm machinery during the last six months of the year reached 12 per cent. of the total output, the approximate proportion of pre-war years.

CASTING NAMES ON BEDFRAMES

By "TRAMP"

Various methods are adopted to cast the manufacturer's name in a prominent position on at least one of the large castings forming a machine. These vary from shop to shop, and occasionally in each shop, depending on the type of name required and the position it occupies in the mould. Some manufacturers prefer a large name of bold Roman characters, whereas others are more inclined to have a smaller name of more artistic letters. The former are more suitable for "bedding in" the mould after the pattern has been withdrawn than are the latter, which are invariably rammed in place.

If the casting is made in dry sand and the name is rammed on a flat surface with the job, difficulty may be encountered when blackwashing the mould, especially if a blacking spray is used. To obviate this it is necessary to make the name plate portion of the mould loose, so as to remain in the mould when the major portion is being blacked, and then on its removal the name can be dressed off separately and care taken that no wash is left in the fine impressions forming the letter.

Alternatively a core print could be placed where the name comes and a suitable core inserted prior to drying. Indeed, for some jobs this is the only practical way, as the name may be situated on a vertical side of the mould, and at considerable depth from the joint, making it impossible for the moulder to get at it to dress it off in such a way as to ensure a fine clear-cut name on the casting.

GERMAN TECHNICAL REPORTS

The Board of Trade (Millbank, London, S.W.1) announce that the following reports of commissions which have visited Germany are available to our readers. The post-free cost is given between brackets:—CIOS XI-13, Elektrowerk Weisweiler: Ferro-alloy manufacture (2s. 1d.). CIOS XXIV-22, Bitterfeld Area, includes fabrication of light metals (3s. 2d.). BIOS89, Vereinigte Deutsche Metallwerke A.G. Frankfurt (Main): Aluminium and magnesium-alloy-castings (2s. 2d.). CIOS XXVI-86, German Steel Foundry Methods (1s. 7d.). CIOS XXVII-40, Deutsche Edelstahlwerke A.G. Bochum: Centrifugal casting of high-alloy steel (7d.). CIOS XXVII-42, Bochum Verin A.G.: Centrifugal castings (7d.). CIOS XXVII-76, German Die Casting Plants (1s. 1d.). CIOS XXIX-3, Production and fabrication of magnesium alloys: I. G. Farbenindustrie, Bitterfeld and Aken (1s. 7d.). CIOS XXIX-26, Ruhrstahl A.G.: Information on plant for the production of castings and forged die blanks (1s. 1d.).

NEW CATALOGUE

Laboratory Press. Griffin & Tatlock, Limited, of Kemble Street, London, W.C.2, have issued a leaflet which describes and illustrates the Microid Nalik Press for use in extruding the alkali metals as wire.

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(*Continued from page* 236.)

sands, the following precautions should be adopted when minimum porosity is desired.

(*a*) Molten metal should be degassed.

(*b*) Pouring temperature should be the lowest consistent with filling the mould, and with other practical requirements.

(*c*) Pouring rate for chill ingots should be higher than that used for maximum soundness in gas-free bronze. The rate should be such as would cause in gas-free metal a density as low as that obtained in the gassy metal. This permits the use of minimum pouring temperature as recommended in (*b*).

(*d*) Sea sand bonded with an oil/cereal agent and baked at 200 deg. C. gives the minimum gassing. If red sand is used, a coarse grade should be employed with 5 per cent. oil/starch (baked at 200 deg. C.) or 5 per cent. water-glass (baked at 300 deg. C.). When practice permits, use of a much higher baking temperature, *viz.*, 600 deg. C., with clay bond, gives the greatest freedom from gassing.

(*e*) Moulded pouring basins, sand-coated metal cores, or normal sand cores, moulds for sand-cast billets, etc., should be baked with maximum air circulation at temperatures given in (*d*). Times required cannot be given since they depend on the mass of the core, etc., and on the degree of air circulation. They must be determined experimentally.

(*f*) When choice of composition is possible, phosphorus content should be $\not>$ 0.25 per cent., lead content as high as possible, tin and zinc the lowest consistent with the required properties.

(2) With certain shaped castings in which perfect feeding is impossible by acceptable gating and feeding methods, a moderate gas content may be intentionally introduced by using a pouring bowl lined with a known sand mixture to give better distribution of porosity.

Acknowledgments

This work was carried out in the Metallurgy Department, University of Birmingham, in collaboration with the Tin Research Institute, and special acknowledgment is due to two members of the staff of the Institute, Dr. K. Winterton, for help in the experimental work, and Dr. J. W. Price, who has carried out in chemical analyses. Approval for publication has been granted by the Chief Scientific Officer, Ministry of Supply.

AN APOLOGY

In our issue of January 31, relative to a lecture given by Mr. G. W. Green, O.B.E., on "Training Problems in the Foundry," to the West Riding branch on December 8, 1945, the remarks attributed to Mr. G. H. Pollard, the hon. secretary of the branch, were actually made by Mr. W. Jones, another member of the branch. We sincerely regret any annoyance caused to either of these gentlemen by this reporting error.

NEW SPECIFICATION FOR WIRE ROPE SLINGS

The existing series of British Standards dealing with rope, chain and terminals for lifting purposes has now been extended by the new British Standard, 1290:1946. This is alternative to and comparable with B.S. 781 for chain slings. The need for a comprehensive standard for wire rope slings has long been obvious.

The slings in B.S. 1290 are made up from standard wire rope and components. To limit variety and ensure safety while affording adequate choice, the wire ropes are restricted to three constructions all of one tensile range formed into three kinds of sling leg fitted at each end with a thimble. The effect of the foregoing limitations is to standardise the size of the rope for a given working load and so facilitate correct selection by the actual slinger.

Unlike chain slings, wire rope sling legs must be sufficiently long to be flexible. The minimum length differs with the detail construction of the leg whether this is single or double part, and where double part, whether it is spliced endless or is in endless grommet. The latter construction gives the least length compatible with adequate flexibility.

Useful Data

A feature of the main rings is that their internal diameters are related to the depth of standard crane hooks in B.S. 482. The working loads of the slings range from 5 cwt. to 15 tons, single, double, treble and quadruple. The standard components for the slings are taken from B.S. 302 (wire ropes for cranes). B.S. 462 (thimbles for wire ropes), B.S. 482 (hooks for cranes and slings) and B.S. 781 (chain slings, rings and links). An interesting fact is that a 60 deg. included angle reduces the permissible load by 13½ per cent., 90 deg. by 29½ per cent., while 120 deg. exactly halves the permissible load of the two legs at 0 deg. In other words a two legged sling rated at 10 tons at 0 deg. becomes a 5 ton sling at 120 deg. included angle.

To increase the utility of the specification the N.P.L. formula for rings in B.S. 781 has been calculated to provide a comprehensive four page table, in the copy of the standard, which gives increments for scantlings, internal diameters and working loads. The ten illustrations of standard slings are to scale and for easy reference the pages facing each figure give an epitome of the make-up of the sling or sling leg to allow selection, inspection and manufacture without continual reference to the preceding text. For further convenience and to render the standard as nearly as possible self-contained, extracts from B.S. 464—thimbles, and B.S. 482—hooks, are reproduced at the end of the publication. Copies of the Standard are procurable from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 3s. 6d., post free.

FOUNDRY UNION MERGER

A ballot is to be taken on March 5 by the members of all the trade unions within the foundry industry on the question of amalgamating all these into one organisation.

HIGH DUTY CAST IRONS

In a Paper which MR. J. J. SHEEHAN, B.Sc., A.R.C.Sc.I., read before the Manchester Association of Engineers on Modern High-duty Cast Irons, some references were made to specific applications of which the following is a selection.

Valve Tappets

A good example of control in manufacture, of specialised application and excellent performance in service is provided by the valve tappets. These have a Rockwell hardness of C45 minimum on the wearing part, and one soft enough to ensure high speed machinability adjacent to this hardness and on other parts of the casting. The wall is thin for lightness but is completely free from brittleness.

A material considered suitable for this application is a low phosphorus iron, containing 0.20 per cent. chromium, and inoculated. The portion of the casting specified to have a hardness of Rockwell C45 is chilled, the chromium content ensuring a high hardness and good wear in service. The low phosphorus content ensures freedom from brittleness on thin-walled sections. The inoculant ensures high graphite content in the unchilled portion and consequent ease of machinability. Performance in service is excellent. All those properties in a casting weighing a few ounces are made possible by accurate melting, metallurgical and moulding control. Camshafts operating with this component are similarly manufactured.

Other Wear-resisting Castings

A wide range of iron castings is used for crushing and grinding equipment and for other abrasion resistant purposes. Examples of such applications are plough points, sand pump castings, ball mill liners, coal crushing plant and cement mills. White or chilled iron gives outstanding service under conditions of rubbing or impingement of abrasives. Alloys are used extensively in white and chilled irons, chromium and molybdenum, to ensure good chill, and nickel, manganese or copper to give toughness to the matrix. White cast iron is produced by two distinct methods:—(*a*) by casting against metal chills, and (*b*) by adjusting the alloy content of the metal. In (*a*) under normal cooling conditions the iron will be grey, by accelerating the cooling rate of that portion which is to be wear resistant, graphitisation is practically suppressed and the carbon in the iron is retained in the combined condition (cementite). In (*b*) it is produced by adjustment of the alloy content of the molten metal so that even on slow cooling the entire casting will be white.

The physical properties of these irons are also controlled by composition, and by the subsequent heat-treatment of the castings. A good example of this latter material is cast iron to B.S. 786, grade 4.

Heat-resisting Cast Irons

The literature under this heading is indeed extensive and the metallurgy most interesting, whilst the engineering applications are almost daily becoming more important and more widespread. In a general presentation, however, selected illustrative examples only can be considered and pictorial presentation most easily justified. Generally, the presence of 1.50 per cent. chromium retards volume changes in the casting up to 870 deg. C. In addition, only a thin adherent scale is evident on a chromium containing iron. If highest oxidation resistance as well as minimum volume change is required at temperatures up to 1,000 deg. C., cast irons containing up to 40 per cent. chromium are used. These irons show little growth at very high temperatures.

Heat-resisting Silicon Irons

A cast iron with 6 to 8 per cent. silicon has been developed by the British Cast Iron Research Association for service at from 700 to 900 deg. C. Copper, nickel and molybdenum also aid in conferring heat resistance to cast iron. These, and the alloys already mentioned, are frequently employed alone or in combination. Special alloy cast irons have been developed for valve seat inserts for internal-combustion engines. A machinable iron containing 1.0 per cent. molybdenum addition to a cylinder iron, is an example of such a product and application. The austenitic irons illustrate this class most excellently. A typical austenitic composition is nickel 15, chromium 2.5, copper 6.0 per cent., remainder iron. High-silicon irons with from 11 to 17 per cent. silicon are also excellent for corrosion resistance. These latter irons are, however, hard and brittle and must be ground instead of machined. Considerable tonnages are used for acid concentration in the explosive and chemical industries. Indeed, it may be mentioned under this heading, as some little concession to plain cast iron, that ordinary cast irons offer excellent resistance to corrosion as compared with other ferrous metals, and is the normal material for pipes and gutters on domestic buildings in our abnormally damp corrosive climate. It also well resists underground corrosion.

The shortest reference to modern high-duty cast iron cannot exclude a reference to cast-iron crankshafts. They are being produced and used on a gradually increasing scale in this country, and in the United States of America the use of grey cast-iron crankshafts for petrol and diesel engine production has developed to the point where certain manufacturers of small engines, including the Waukesha Engine Company and Hill Diesel Company, are fitting them in some of their models from 10 h.p. single cylinder up to 150 h.p. eight cylinder, and are satisfied that they are a sound mechanical proposition.

In the larger engine field, the chief user of cast-iron crankshafts is the U.S. Navy, in engines made by Fairbanks-Morse, and these crankshafts, all of which are in diesel engines, are of 9 to 10 throw type with the crankpins of 6¾ in. dia. and journals of 8 in. dia. The Ford Motor Company, Limited, in this country and in America, is the largest user of the medium and light weight shaft. Typical compositions of irons used for the purpose are shown in Table I.

Several users and consultants seem to think the future of cast crankshaft material is in producing a less costly non-alloy cast iron, suitably heat-treated to give the required physical properties; another development is in the direction of heat-treated pearlitic malleable which could be produced to give a tensile

TABLE I.—*Typical Composition of Iron used for Crankshafts.*

	T.C.	C.C.	Si	Mn	S	P	Ni	Mo	Cr
Submarine	2.7	0.7	2.4	1.0	0.08	0.08	1.0	1.0	0.20
Automobile	3.3	0.8	2.4	0.7	0.15	0.18	0.2	0.4	0.8

of 90,000 lb. per sq. in. (40 tons per sq. in.). "Arma" steel is a typical material of this type and has a composition as follows:—A.R.M.A. Steel, Si 1.5, T.C. 2.5, Mn 0.40, S 0.17 max., P 0.10 max. per cent.

The use of acicular cast iron for crankshafts and other applications, is increasing rapidly with a range of tensile strength of 18 to 36 tons per sq. in. and a composition varying from :—T.C. 2.3 to 2.7, Ni up to 2.0, and Mo 0.5 to 0.7 per cent., and inoculated with a nickel/silicon alloy or with ferro-silicon which can be used in quantities to give a final silicon content of 2.5 per cent. The phosphorus content should not be more than 0.15 per cent. and there must be an appreciable steel charge in the furnace. The material could be annealed at 204 deg. C. from 3 to 15 hours, depending on section, when tensile strengths up to 40 tons per sq. in. could be obtained.

Gas Pressure Castings

Many of the high-duty irons approximate to steels in their physical characteristics. This is so in their characteristics of liquid shrinkage, which is higher for many of them than for ordinary cast iron. It is possible to counteract this and produce sound castings free from internal shrinkage, by the provision of larger feeder heads, as is usual in steel casting practice.

Recently, however, a much superior method* devised and described by Jazwinski has become available. Gas pressure is developed in the feeding head by means of a gas-producing compound placed inside the mould-head cavity. This gas pressure forces liquid metal into the cavities of the casting, producing a sound and dense product. This new process is being applied to iron castings with marked success.

*A New Method of Feeding Applied to Castings made in Static Moulds, by S. J. Jazwinski and S. L. Finch—FOUNDRY TRADE JOURNAL, page 269, November 29, 1945.

NOTES FROM THE BRANCHES

SCOTTISH.—It has been found necessary to alter the subject to be discussed at the meeting scheduled for March 9. The speaker will now be Mr. D. H. Young, Glasgow, and his subject "Cupola Operation." It is expected that Mr. J. W. Gardom, the President of the Institute, will be present at this meeting and at the Annual Dinner, held later in the Grosvenor Restaurant. The meeting is otherwise as detailed on page 168 of our issue of February 14.

PROGRESS IN BATH-MAKING

VISIT TO GREENFORD

Last Thursday, Mr. W. Leonard, Parliamentary Secretary to the Ministry of Supply, accompanied by prominent trade-union leaders and representatives of the Press, visited the works of the British Bath Company, Limited, at Greenford, Middlesex. This concern in pre-war days had an output of 2,000 baths per week. During the war, this type of manufacture was entirely suspended, and the works was given over to the making of munitions. Thus, but a few months ago, the management had to recreate their manufacturing process from zero. However, such progress has been made that the current production is of the order of 1,200, with every hope of achieving pre-war production by mid-summer. This excellent output is being given by three Sandslinger units, despite the fact that the third one is being at the moment used for training purposes. The labour position is that 35 men, exclusive of the crane drivers, are producing 250 baths in 7½—that is about one man hour per casting. A new plant for an airless Wheelabrator abrasive cleaning machine, the first of its kind, has recently been installed.

Pressed Steel Baths

At a luncheon which followed the visit, Mr. J. Shaw, chairman and managing director of Allied Ironfounders, Limited, the parent company, said there had been references in the Press to the fact that Allied Ironfounders, Limited, had acquired a new compnay—Allied Steel Pressings, Limited—which company was engaging in the manufacture of pressed steel baths. The visit to-day to the works of the British Bath Company had demonstrated the magnitude and importance of Allied Ironfounders' interest in cast-iron bath production, and he emphasised that whilst Allied Ironfounders, in entering this new field of pressed steel baths, would add to the total number of baths available for the nation's housing programme, the company would not in any way reduce their activities in the cast-iron bath field; on the contrary, it was the company's intention rapidly to increase the production of cast-iron baths and to supplement it as early as they could with additional numbers of pressed steel baths. He had great expectations that as and when conditions in the home market permitted, export of the pressed steel bath would capture for British trade markets held in pre-war days by Continental pressed steel bath makers.

MR. D. W. COOPER, who, in February, 1942, was seconded from George Cohen, Sons & Company, Limited, to take up the appointment of Assistant Controller of Machine Tools at the Machine Tool Control, and has for the last year been Director of Machine Tool Disposals, has joined the board of the Selson Machine Tool Company, Limited, one of the group of companies of which George Cohen, Sons & Company are the parent concern.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN

The following particulars relating to pig-iron and steel production in Great Britain have been extracted from the "Statistical Bulletin" for January, 1946, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and blast-furnace ferro-alloys, with the number of furnaces in blast in December, 1945, Table II, production of steel ingots and castings in December, 1945, and Table III, deliveries of alloy and non-alloy finished steel. Table IV summarises the activities of the steel industry as a whole during the last six months of 1945.

TABLE I.—*Production of Pig-Iron and Blast-Furnace Ferro-Alloys. (Thousands of Tons.)*

	Furnaces in blast Dec. 29, '45.	Weekly average production, December, 1945.					
		Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts, Northants and Essex ..	21	—	15.2	15.6	1.4	—	32.2
Lancs (excl. N.W. Coast), Denbigh, Flint and Ches. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	7	—	5.9	—	—	1.7	7.6
Lincolnshire ..	13	—	19.5	0.7	—	—	20.2
North-East Coast	25	5.6	27.2	0.5	—	1.2	34.5
Scotland	10	0.6	9.4	2.1	—	—	12.1
Staffs., Shrops., Worcs. and Warwick	9	—	5.9	1.0	—	—	6.9
S. Wales and Monmouth	7	2.8	16.2	—	—	—	19.0
North-West Coast	7	12.0	—	0.4	—	0.6	13.0
Total ..	99	21.0	99.3	20.3	1.4*	3.5	145.5
November, 1945..	99	22.0	106.7	17.6	0.9	2.8	150.0
December, 1944	100	19.2	93.0	17.5	0.6	2.4	132.7

TABLE IV.—*General Summary of Pig-Iron and Steel Industry. (Weekly Average in Thousands of Tons.)*

	Iron ore output.	Imported ore consumed.	Output of pig-iron and ferro-alloys.	Scrap used in steel making.	Output of steel ingots and castings.	Deliveries of finished steel.	Steel* stocks held by producers, etc.
1944 ..	297.6	46·8	129.5	141.7	233.5	197.5	2,171.0
1945 ..	272.5	77.2	136.7	138.5	227.3	171.6	1,683.9
1944, December	286.0	52.2	132.7	132.4	219.7	169.1	1,697.5
1945—							
July ..	274.5	77.5	134.8	133.3	213.6	155.2	1,317.4
August ..	221.4	77.9	125.2	110.6	185.9	142.3	1,280.8
September	246.3	97.8	139.5	145.1	240.6	176.9	1,263.8
October	247.6	106.3	146.1	146.1	243.0	166.5	1,211.5
November	249.0	104.4	150.0	147.3	246.9	179.4	1,212.5
December	231.4	100.4	145.5	132.3	221.7	164.0	1,190.6

* Stocks at the beginning of the years and months shown.

TABLE II.—*Production of Steel Ingots and Castings. (Thousands of Tons.)*

	Weekly average production, December, 1945.						
	Open-hearth.		Bessemer.	Electric.	All other.	Castings.	Total ingots and castings.
	Acid.	Basic.					
Derby, Leics., Notts, Northants and Essex ..	—	—	10.1 (basic)	1.0	0.3	0.4	11.4
Lancs (excl. N.W. Coast), Denbigh, Flint and Ches. Yorkshire (excl. Sheffield and N.E. Coast) ..	1.3	14.8	—	1.1	0.3	0.7	17.5
Lincolnshire ..	—	17.4	—	—	0.1	0.1	17.5
North-East Coast	2.8	43.8	—	0.4	0.4	1.0	47.4
Scotland	5.1	32.6	—	0.4	0.6	1.4	38.7
Staffs., Shrops., Worcs and Warwick	—	10.7	—	0.2	0.4	0.6	11.3
S. Wales and Monmouth	4.6	35.4	4.8 (basic)	0.5	0.1	0.3	45.4
Sheffield	7.7	14.0	—	4.3	0.5	1.2	26.5
North-West Coast	0.3	2.2	3.5 (acid)	—	—	0.1	6.0
Total ..	21.8	170.9	18.4	7.9	2.7	5.8	221.7
November, 1945..	23.6	191.3	19.5	9.4	3.1	6.7	246.9
December, 1944..	21.9	166.7	15.2	11.0	4.9	10.2	219.7

TABLE III.—*Deliveries of Alloy and Non-Alloy Finished Steel. (Thousands of Tons.)*

	Weekly average.				
	1944.	1945.	1944.	1945.	
			Dec.	Nov.	Dec.
Heavy rails and sleepers.. ..	6.5	7.1	6.2	8.3	10.3
Heavy and medium plates ..	30.8	26.4	26.5	30.5	28.3
Plates—alloy	1.9	1.1	1.5	0.4	0.6
Other heavy steel products ..	38.2	33.1	33.9	30.3	29.0
Light rolled products (excl. wire rods and alloy steel bars) ..	46.2	41.9	44.3	48.6	39.7
Ferro-concrete bars	2.1	1.8	0.7	2.6	2.0
Cold-rolled strip (excl. alloy) ..	4.2	4.0	3.2	3.8	3.3
Bright steel bars (excl. alloy) ..	4.9	3.9	3.9	3.7	3.2
Sheets, coated and uncoated (excl. alloy)	21.2	20.2	19.0	21.4	17.8
Tin, terne and blackplate ..	10.0	9.5	9.5	9.8	9.5
Tubes, pipes and fittings ..	12.9	11.2	10.3	12.0	11.8
Steel wire (excl. alloy)	13.2	10.2	9.9	11.1	9.2
Alloy bars, sheets, strip and wire	5.6	3.0	3.6	2.7	2.3
Steel tyres, wheels and axles ..	2.6	2.5	2.4	3.1	3.1
Steel forgings	10.9	7.5	9.0	6.2	5.8
Steel castings	6.8	5.0	5.8	3.7	3.2
Total production*	217.0	188.4	189.7	198.2	179.1
Less intra-industry conversion ..	24.5	17.8	21.8	18.8	15.2
Total deliveries	192.5	170.6	167.9	179.4	163.9
Deliveries of imported finished steel	5.0	1.0	1.2	—	0.1
Total deliveries of finished steel	197.5	171.6	169.1	179.4	164.0

* Includes finished steels produced in the U.K. from imported ingots and semi-finished steels.

PLANS HAVE BEEN APPROVED for an office block at Hebburn for Palmers Hebburn Company, Limited. The scheme is part of a £500,000 development plan.

NATIONALISATION, PRODUCTION AND ECONOMIC RECOVERY

F.B.I. STATEMENT OF POLICY

The Government's nationalisation programme and the problem of increasing production were the subject of a statement of policy issued last week by the grand council of the Federation of British Industries. The statement says that the policy of the F.B.I. is dictated solely by the interests of our national and industrial economy. They reject completely the conception that the nationalisation of industry is in the interests of employment, of production, or of the consumer. Now that the Government's Bill for the nationalisation of coal mining has been given a second reading, our duty and endeavour must be to ensure that the great dangers and disturbances inherent in this vast structural change are reduced to a minimum, the statement continues.

The Lord President on November 19 made it clear that no final decision had yet been reached on the future organisation of the iron and steel industry. Aside from its general conviction that nationalisation of productive industry is against the interests of employment and production, the Federation affirms its view that, because of the structure of this industry, any attempt to nationalise it would gravely endanger the smooth and effective restoration of the steel-using industries and their maintenance at the levels of output demanded by our new economic situation.

The proposals for the nationalisation of transport and the removal of the element of competition from this important component of the cost of production are causing very serious concern. Road haulage is particularly closely integrated with productive industry, and the nationalisation of this section cannot fail to impose restrictions which will seriously reduce the flexibility and efficiency of road haulage.

Outlook in Economic Sphere

The Federation urge that the Government should concentrate its immediate efforts upon the economic situation of 1946. The position is grave, and the outlook in the economic sphere is as critical as it was in the military sphere at the time of Dunkirk. By the end of 1946 we must have laid the foundations necessary for the re-establishment of equilibrium in relation to our oversea payments. Unless we can make much faster progress in restoring our production than is yet apparent we may well be face to face with calamity. There must be the closest co-operation between Government, employers, and workers, and a realisation on the part of all that practical questions of production must take precedence over all other considerations.

Not only should the present taxation burden on production be lessened, including the abolition of E.P.T., but it is imperative not to introduce new forms of taxation bearing specifically upon industry.

CROWN WELDING COMPANY, LIMITED, is being wound up voluntarily. Mr. H. E. Kneale, St. George's Chambers, 1, Athol Street, Douglas, is the liquidator.

OBITUARY

MR. JOHN MACKENZIE, managing director of A. E. Powrie & Son, Limited, iron and steel merchants, Dundee, died recently.

MR. A. E. BIGGIN, who since 1923 had been managing director of George Tucker & Company (Sheffield), Limited, stainless steel and metal stockholders, of Norfolk Street, Sheffield, has died after a prolonged illness. He was 71. Mr. Biggin had been in ill-health for several years. His father, Mr. Joshua Biggin, took the firm over 50 years ago.

MR. G. CLEMENT JENKS, chairman and managing director of the British Tool & Engineering Company, Limited, of Bushbury, Wolverhampton, which he founded with his brother, Mr. R. P. Jenks, and also of its associated company, John Shaw & Sons (Wolverhampton), Limited, which recently celebrated the 150th anniversary of its foundation, has died suddenly. For three years during the war Mr. Jenks acted as Director of Hand Tools under the Ministry of Supply. He was 59 years of age.

MR. TOM SWIFT PEACOCK, deputy chairman of Guest, Keen & Nettlefolds, Limited, died at his home, Summerhill Grange, Kingswinford, Dudley, on February 16, at the age of 77. As a youth Mr. Peacock entered a solicitor's office, but in 1887 he became assistant buyer to a firm of iron merchants at Leeds. At the age of 18 he was promoted buyer. He was appointed secretary of F. W. Cotterill, Limited, nut and bolt manufacturers, of Darlaston, in 1892, and in June of the following year he was made general manager, becoming managing director seven years later. The firm subsequently became known as Guest, Keen & Nettlefolds, Limited. His son, Mr. Kenneth Peacock, is managing director of the company.

MACHINE TOOL ELECTRICAL EQUIPMENT

The Control of Machine Tools (Electrical Equipment) (No. 2) Order, which came into force on February 25, amends the Control of Machine Tools (Electrical Equipment) (No. 1) Order, introduced in 1941 to safeguard the supply of electrical equipment for machine tools. The new Order removes certain restrictions on the manufacture and supply of electrical equipment for machine tools and on the requirements which buyers of such equipment may impose.

Article 2 of the original Order is not being revoked, so as to retain the provision which afforded protection to consumers when three-phase electric motors up to 5 h.p. are started direct to line and those up to 30 h.p. are of the squirrel-cage type in contravention of the varying electric supply authorities' regulations. The Ministry of Supply states that by this means a desirable degree of standardisation of machine-tool electrical equipment has been effected, and it is on this account, and in fairness to consumers who have installed such equipment, that the provision is being retained.

Copies of the new Order can be obtained from H.M. Stationery Office, York House, Kingsway, London, W.C.2, or through any bookseller, price 1d. (S.R. & O., 1946, No. 207).

Save Fuel

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BY USING
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SAND-LESS
MACHINE CAST
PIG IRON

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

PERSONAL

MR. R. BLANKLEY has been appointed general manager of International Corrodeless, Limited, of Enfield.

MR. T. MAKEMSON, O.B.E., Director of Iron Castings, Iron and Steel Control, has left for Germany, where he expects to remain for about a fortnight.

MR. G. E. WINYARD, proprietor of the Station Engineering Company, Moxley Road, Bilston, is a candidate for a seat at a by-election for the Bilston Town Council.

MAJOR STEWART OWEN, who has recently returned from the Forces, has been appointed acting area manager (Scotland) for David Brown & Sons (Huddersfield), Limited.

MR. W. L. HARDY has been appointed foundry manager of Lake & Elliot, Limited, of Braintree, Essex, to succeed Mr. C. H. Kain on his appointment as joint managing director.

MR. ARTHUR H. RICE, managing director of Rice & Company (Northampton), Limited, ironfounders, etc., is standing as a candidate in the forthcoming County Council election.

MR. ALBERT PARKINSON has succeeded his brother, the late Mr. Frank Parkinson, as chairman and joint managing director of Crompton Parkinson, Limited, and its associated companies.

DR. J. ALLEN, senior lecturer in engineering at Manchester University, has been appointed to the Jackson Chair of Engineering at Aberdeen University. He succeeds the late Prof. Blackadder, who died some years ago, but whose place was not filled during the war. Dr. Allen, a native of Manchester, is 39.

SIR FREDERICK BAIN, a deputy chairman of Imperial Chemical Industries, Limited, has been appointed deputy president of the Federation of British Industries. Sir Frederick was from 1941 to 1944 chairman of the Chemical Control Board, Ministry of Supply, and chairman of the Chemical Planning Committee of the Ministry of Production.

LT.-COMMANDER C. U. FISHER, R.N.V.R., has been appointed chief engineer of International Corrodeless, Limited, Enfield, Middlesex. Lt.-Commander Fisher has served in the Royal Navy in a technical capacity for six years, first in the minesweeping service and later in H.M.S. "Rodney." Prior to joining the Navy he was with the British Thomson-Houston Company, Limited, Rugby.

MR. A. J. SOMERS, F.R.I.C., who has been appointed a director of Borax Consolidated, Limited, has been sales manager since 1940, having served in various other capacities during his 25 years with the company. He studied at the Royal College of Science and obtained an honours degree in chemistry. He takes a keen interest in the enamel and allied industries, especially on the technical side, and regularly participates in the activities of the Institute of Vitreous Enamellers.

MR. A. E. RYELAND, MR. B. N. JOLLY and MR. F. A. ALLEN have been elected to the board of E. Boydell & Company, Limited, Manchester. Mr. Allen is works manager of the company, while Mr. Ryeland is responsible for sales of Muir-Hill equipment in Southern England. Mr. Jolly has been the company's general manager for many years. MR. EDWARD BOYDELL, founder and managing director of the company, continues as chairman of the new board, and the fifth member, MR. H. E. EVANS, who was the only other director until recently, continues to serve in the capacity of financial adviser.

MR. WILLIAM J. WIGNEY has been appointed vice-chairman of Andrews Toledo, Limited, Sheffield. He relinquishes the appointment of managing director which he has held since 1937, and is succeeded in that office by MR. MALCOLM BROWN, formerly of Hadfields, Limited, Sheffield. Mr. Brown is the son of Sir Peter Brown, formerly chairman and managing director of Hadfields, Limited. Mr. Brown also becomes managing director of the Wardsend Steel Company, Limited. Mr. Wigney is chairman of the Wardsend Steel Company, Limited, and managing director of Darwins, Limited.

DR. LESLIE AITCHISON has been apointed to the newly-established Chair of Industrial Metallurgy at Birmingham University. This appointment, the first of its kind in a British university, will lead to the training of metallurgists for industrial as well as purely research purposes, and will give to students at Birmingham University courses of instruction not available at any other school of metallurgy. Prof. Aitchison was educated at Sheffield University, where he became a Doctor of Metallurgy and subsequently a lecturer in the Metallurgical Department. He is also a B.Sc. of London. Among appointments he has held are those of consulting metallurgist to the Air Ministry, the Association of Drop Forgers and Stampers, and various motor firms in Birmingham district. He is a past-president of Birmingham Metallurgical Society and has written extensively on metallurgical subjects. In 1921, through the Andrew Carnegie Research Scholarship, the Iron and Steel Institute awarded him £100 to assist in carrying out an investigation of the low apparent elastic limit in quenched and work-hardened steels, with particular reference to fatigue, strength, proof, stress and constitution.

Wills

REES, H. D., of Porthcawl, late a director of the Briton Ferry Steel Company, Limited	£49,160
JEMMETT, L. D., joint managing director of Manley & Regulus, Limited, brassfounders, etc., of Wolverhampton	£20,026
WILSON, C. H., of London, S.W., for many years managing director of the Sheffield Smelting Company, Limited	£20,042

Acknowledgment.—We regret that we omitted to state that Mr. C. Howson's Paper, printed on page 191 *et seq* of our last issue on the subject of "The Formation of Banded Structures in Horizontal Centrifugal Castings," was presented to the Sheffield branch of the Institute of British Foundrymen.

Design by Victor Reinganum

MOSAICS OF STEEL

NUMBER ONE

Cast iron as an engineering material has found fresh favour with the advent of high duty irons. The materials, in strength, soundness and physical properties, are a great improvement on the best cast iron of a generation ago. Workington irons enjoy unusual confidence amongst foundry men, particularly for special duties. The unique conditions existing at Workington contribute to the production of superior irons. The pure hematite ores are mined locally and, with rigid control throughout all processes, result in a product having a low sulphur and phosphorus content. All iron manufactured is machine cast and is free from sand and awkward pieces. Refined irons are also made from virgin metal without remelting or the addition of scrap. They are therefore eminently suitable for the production of malleable iron and special castings. Workington pig iron is used as the basis of the finest acid steels.

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THE SHEFFIELD COAL CO. LTD., TREETON
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USP. 45

NEWS IN BRIEF

RICHARD CRITTALL & COMPANY, LIMITED, heating and air-conditioning engineers, have moved to 156, Great Portland Street, London, W.1.

BRIXTON NON-FERROUS METALS, LIMITED, is being wound up voluntarily. Mr. F. T. Smith, 150, Southampton Row, London, W.C.1, is the liquidator.

STOCKTON-ON-TEES CORPORATION has approved a proposal by Head, Wrightson & Company, Limited, to build an ironfoundry in Yarm Road, adjacent to the firm's present foundry.

THE CONTROL OF TALC AND PYROPHYLLITE (NO. 2) (REVOCATION) ORDER, 1946, has been made revoking the No. 1 Order, 1943, which regulated the acquisition and disposal of those materials.

THE HOFFMANN MANUFACTURING COMPANY, LIMITED, Chelmsford, are opening an additional branch office at 5, Municipal Buildings, Charles Street, Leicester. A stock of bearings will be carried.

A "GOOD HEATING FOR EVERY HOME" EXHIBITION is to be held at the Royal Horticultural Hall, Vincent Square, Westminster, London, S.W.1, from March 13 to 30. Many foundry concerns are collaborating.

NEARLY 90 PER CENT. of employees of the Ford Motor Company, Limited, belong to the firm's savings groups and the average weekly contribution of each member is 16s. 6d. The grand total recently passed the £3,000,000 mark.

A DEVELOPMENT ASSOCIATION to draw attention to the facilities which exist at Bonnybridge, Stirlingshire, for industrial expansion has been formed. At present Bonnybridge is chiefly concerned with the production of iron castings for the building trades.

LANCASHIRE DYNAMO & CRYPTO, LIMITED, announce that they intend to increase export trade through the formation in South Africa of a subsidiary selling company, registered in the Union. The new capital is also required for the erection of a new factory at Bridgewater.

JOHN GARRINGTON & SONS, LIMITED, manufacturers of drop forgings, of Darlaston, have taken over Newton Works, a large factory at Aston Fields, Bromsgrove, which was built for the Deritend Stamping Company, Limited, during the war. Eventually they plan to employ more than 1,000 workers there.

ALLIED IRONFOUNDERS, LIMITED, has received permission to deal in new shares. The company is offering to shareholders one new £1 ordinary share at 47s. 6d. for every 25 shares already held. This represents an increase of £66,977 in the issued ordinary capital to £1,741,399. There is also an issue (£994,591) of 7 per cent. cumulative preference shares of £1.

IRISH STEEL, LIMITED, Haulbowline, Cork, is preparing to restart production and hopes to be able to reengage 40 to 50 workers as a beginning. Initial production, it is understood, will be confined chiefly to the manufacture of finished products from the stock of steel billets in hand. A moderately large consignment of these arrived from Canada several months ago.

F.B.I. CONFERENCE ON INDUSTRY AND RESEARCH

Sir Robert Robinson, president of the Royal Society, will open the two-day conference on industry and research, organised by the Federation of British Industries, to be held in the Kingsway Hall, London, on March 27 and 28.

The conference wll be divided into four sessions, as follow:—

Wednesday (March 27):—10.30 a.m.: *Science, Industry and the Community*. Chairman, Sir Clive Baillieu, K.B.E., C.M.G., president of the F.B.I. Opening address: Sir Robert Robinson, president of the Royal Society. Speakers: Sir William Larke, K.B.E.; Sir Edward Appleton, F.R.S.; Sir Harold Hartley, F.R.S., K.C.V.O.; and Sir Ernest Simon, LL.D.

2.15 p.m.: *Scientific Research and Production*. Chairman: The Rt. Hon. Sir Stafford Cripps, K.C., M.P., President of the Board of Trade. Papers: "Research and Quality," by Dr. J. R. Hosking, Director of Research and Development, Paints Division, I.C.I., Limited; "Research and Production Costs," by Mr. A. Healey, Director of Production, Dunlop Rubber Company, Limited; and "Conversion of the Results of Research into Production," by Dr. C. C. Paterson, F.R.S., head of the research laboratories, General Electric Company, Limited. Address: The Rt. Hon. Sir Stafford Cripps, K.C., M.P.

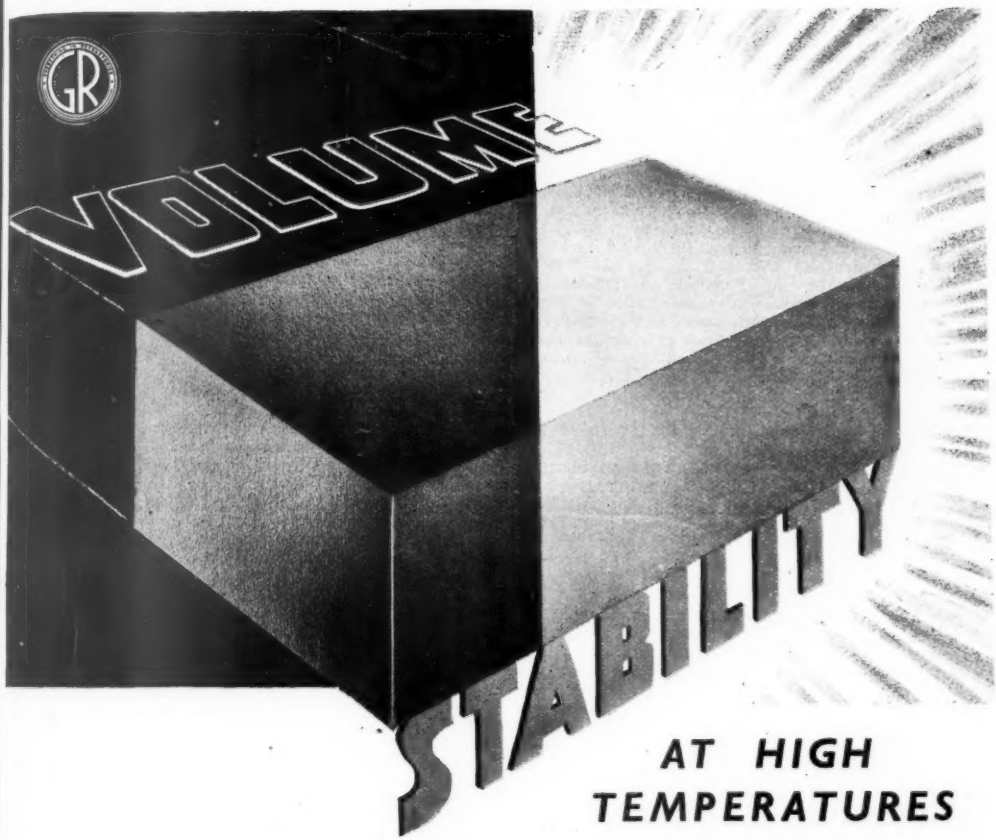
Thursday (March 28):—10 a.m.: *Scientific Research and Industrial Expansion*. Chairman: The Rt. Hon. Herbert Morrison, M.P., Lord President of the Council, who will give an address. Papers: "How New Industries Arise," by Dr. R. E. Slade, lately Research Controller, I.C.I., Limited; "Modernisation of Processes and Plant," by Mr. C. H. Davy, chief research engineer, Babcock & Wilcox, Limited; and "The Part Co-operative Research Can Play," by Mr. A. J. Philpot, Director of the Scientific Instrument Research Association.

2.15 p.m.: *The Application of Research in Industry*. Chairman: The Rt. Hon. Sir John Anderson, F.R.S., M.P., who will give an address. Papers: "The Firm with a Research Department," by Dr. P. Dunsheath, President of the Institution of Electrical Engineers and Director and Chief Engineer, Henleys W.T. Telegraph Works, Limited; and "The Firm Without a Research Department," by Sir Raymond Streat, chairman of the Cotton Board.

At the end of the conference, Sir William Larke, chairman of the F.B.I. Industrial Research Committee, will sum up.

DEATH OF MR. A. A. LIARDET

The death is announced of Mr. A. A. Liardet, general manager of Leyland Motors, Limited. Before his appointment, in 1924, he was general manager of Thwaites Bros., Limited, of Bradford, who were both foundry equipment and steel castings manufacturers. It was at this time that he took a profound interest in foundry technology and was a founder and the first president of the West Riding of Yorkshire branch of the Institute of British Foundrymen. He retained his interest in foundry work throughout his very successful career with Leyland Motors, Limited.



AT HIGH TEMPERATURES

FIREBRICKS · BASIC BRICKS
ACID-RESISTING MATERIALS
INSULATION · SILLIMANITE
AND HIGH ALUMINA BRICKS
SILICA BRICKS · PATCHING
AND RAMMING MATERIALS
REFRACTORY CEMENTS · SANDS

THE *abnormal* expansion or contraction of refractory products endangers both the furnace structures and the process. It is one of the many aspects of refractories' manufacture which is subject to normal routine control in all G.R. works, where the maximum permissible firing temperatures are applied to ensure that all G.R. refractory products are volume stable in use. G.R. engineers are available on request to advise users on the selection and application of refractory products.

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Raw Material Markets

IRON AND STEEL

The general engineering and jobbing foundries have no difficulty in securing what pig-iron they desire for current work, which is expanding, and to allow of reasonable stocks. Some foundries would buy larger quantities and take heavier tonnages for stock, as they fear shortages later and also higher prices, but "free" buying is not permitted and only licensed quantities can be purchased. Gradually these foundries are becoming busier and the total demand of low- and medium-phosphorus iron, hematite and refined pig is impressive. Good stocks of these grades of pig-iron are held at the furnaces, but stocks of high-phosphorus iron, used largely by the light-castings trades, are meagre and cause much anxiety to the Control and uneasiness to the foundries who may be aware of the position.

It is still necessary for many furnaces to be kept on the production of basic pig for the steelworks and steel supplies have got to be stepped up still further. Only recently furnaces producing foundry pig were switched on to basic and it is also reported that this type of pig-iron has also been bought from abroad. More steel will have to be produced, because it is not possible for us to buy raw steel from abroad in anything like the quantities needed here to keep the re-rolling plants in operation. Every ounce of high-phosphorus foundry pig-iron that can be made will be wanted in the coming months by the light-castings trade. All are heavily engaged and there are tremendous orders for light castings for the building and ancillary trades yet to be placed. More skilled men are getting back to the foundries, but ordinary labour is still very short and retards supplies. All foundries are now wanting large quantities of scrap, either cast iron or steel or both. Up till a few weeks ago supplies had been coming through satisfactorily, but more recently supplies have been tighter and many users are complaining of lack of tonnage of suitable grades of scrap. Pig-iron is too scarce and costly to use in its place.

Supplies of cupola coke are just about keeping pace with current demand, but many foundries are working on a hand-to-mouth basis for supplies, which is dangerous, as stocks in most places are low. In most areas supplies of coke are rationed. Foundries are obtaining all reasonable requirements in limestone and ganister, and firebricks can be obtained at short notice in most cases. Ferro-alloys for use in the engineering foundries are in good supply, but licences are still necessary.

As iron in these days is not in wide request, most of the ironworks keep their mills in full operation by rolling down steel billets into shapes or strip. Crown bars are in poor request, but there remains a steady call for best bars for the heavy industries and also for No. 3 and No. 4 iron. Little, however, is heard of strip and the call for iron sheets is negligible. Makers of iron get all the forge pig-iron they require, but the right type of scrap presents difficulties.

There are enough orders to keep the sectional and plate mills busy for a long time ahead and fresh commitments arrive daily. At some of the steelworks stocks of finished joists, sections and plates are increasing due to lack of wagons, embargoes in certain areas and also the aftermath of the dock strikes.

NON-FERROUS METALS

The first issue of the International Tin Research and Development Council's "Statistical Bulletin" to be published for several years contains interesting figures relating to production and consumption of tin during the war years. Owing to the inevitable difficulties of compiling statistics in wartime, many of the figures given are estimated, but from them it is possible to gain a useful outline.

World production of tin is given as follows:—1939, 183,500 tons; 1940, 235,000; 1941, 245,500; 1942 125,000; 1943, 121,500; 1944, 109,000 tons. Consumption in the United Kingdom for the same years was: 27,279 tons, 29,225, 30,000, 23,478, 17,631, 18,435 and, in the first nine months of 1945, 11,975 tons. United States consumption over the period was: 70,315 tons, 75,000, 100,870, 60,000, 56,000, 65,000 and 33,000 tons in the first seven months of 1945.

On the question of smelting capacity available at the end of the war, the "Bulletin" states that only incomplete data are available as yet concerning the large smelters in Asia, and therefore it is still infeasible to ascertain the real extent of the recession in smelting capacities, which is to be reckoned with in any case; it is also indeterminable how long the rehabilitation of this industry will last. In Europe the Arnhem smelter was severely hit by enemy action, but it is expected that within a measurable space of time this smelter will be able to resume its production. Against the decline of the total smelting capacity in Asia and Europe, whether temporary or otherwise, can be set the establishment of a new smelting works, the Texas smelter in the United States, during the war. This American State-owned smelter has a productive capacity of about 50,000 tons a year, which means an important credit-item in respect of the world's smelting capacity. It may be assumed that world's smelting capacity will not lag behind that of the tin winnings; on the contrary, the former will, just as was the case formerly, exceed the tin-ore production considerably.

The lead shortage continues to cause much concern. The outlook for consumers in the second quarter does not promise to be any more favourable. A great deal depends on the extent to which the Government have covered themselves ahead, as, if they have failed in this direction, the future may well be distressing from the consumer's point of view. Lead imports in November of last year amounted to only 400 tons; in October they were 6,400 tons. The monthly average for the first 11 months of 1945 was 15,880 tons, which compares with an average of 18,700 in 1944 and 18,900 tons in the previous year. The monthly average for the pre-war years 1935-1939 was 29,800 tons. The trend of events is thus evident from these figures. Lead must play an important part in many phases of reconstruction, and in building in particular, so that the situation gives no cause for complacency.